NAVSHIPS 91559

INSTRUCTION BOOK

*for*

# RADIO RECEIVER EQUIPMENT NAVY MODEL RBA-7

67 SHOP
ELECTRONICS, BLDG. #121

FEDERAL TELEPHONE AND RADIO CORPORATION
CLIFTON, NEW JERSEY

BUREAU OF SHIPS NAVY DEPARTMENT

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*Contract: NObsr-52110*

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DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Code 993-100
21 November 1951

From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation and Maintenance of the Subject Equipment

Subj: Instruction Book for Radio Receiving Equipment Navy Model RBA-7 NAVSHIPS 91559

1. This is the instruction book for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense Publications.

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H. N. WALLIN
Chief of Bureau

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**SECTION 8—PARTS LISTS**

# GUARANTEE

The equipment, including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f. o. b. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government; provided that such guarantee will not obligate the Contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the Contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts, as defined above, is of the Contractor's design or is of a design selected by the Contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten percent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such item will be conclusively presumed to be of defective design and subject to one hundred percent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the Contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for affecting expeditious adjustment under the provisions of this contractual guarantee.

The above one year period will not include any portion of time the equipment fails to perform satisfactorily due to any defects, and any items repaired or replaced by the Contractor will be guaranteed anew under this provision.

# INSTALLATION RECORD

Contract Number NObsr-52110 Date of Contract, 6 December 1950

*Serial Number of equipment*.....

*Date of acceptance by the Navy*.....

*Date of delivery to contract destination*.....

*Date of completion of installation*.....

*Date placed in service*.....

Blank spaces on this page shall be filled in at time of installation.

# REPORT OF FAILURE

Report of failure of any part of this equipment, during its entire service life, shall be made to the Bureau of Ships in accordance with current regulations using form NAVSHIPS NBS 383 (revised). The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the *Bureau of Ships Manual* or superseding instructions.

# ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Standard Navy stock number or, when ordering from a Marine Corps or Signal Corps supply depot, the Signal Corps stock number.
2. Name and short description of part.

If the appropriate stock number is not available the following shall be specified:

1. Equipment model or type designation, circuit symbol, and item number.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. JAN or Navy type number.

# SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the *Bureau of Ships Manual* or superseding instructions on the subject of radio-safety precautions to be observed.

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

**KEEP AWAY FROM LIVE CIRCUITS:**

Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

**CAUTION**

Remove the a-c power supply connection, or the interconnecting power cable, whenever working inside the receiver. A-c power (115 volts) appears at certain live points in the chassis whenever the power supply is plugged in.

**DON'T SERVICE OR ADJUST ALONE:**

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

**DON'T TAMPER WITH INTERLOCKS:**

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

# RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

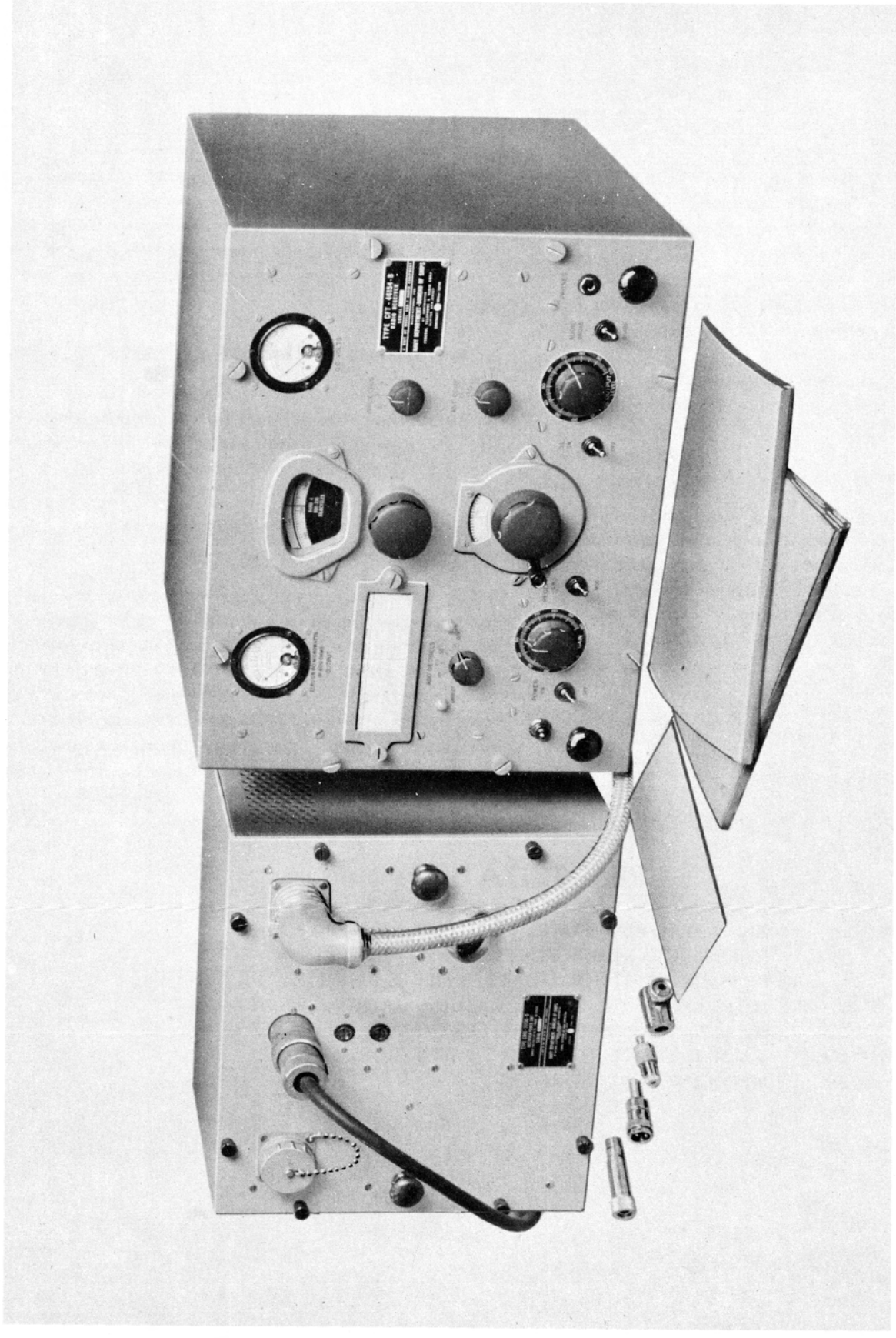


*Figure 1–1. Model RBA-7 Equipment*

# SECTION 1
# GENERAL DESCRIPTION

## 1. INTRODUCTION.

The Model RBA-7 Radio Receiving Equipment is a long-wave communications receiver designed for use aboard ship or in land-based stations. The equipment covers the range of 15 to 600 kc and is adapted to receive $A_1$, $A_2$, and $A_3$ emission (CW, MCW, and voice). Selectivity of the receiver, however, is such that voice reception will be of low quality and probably will be unusable below 300 kc.

## 2. DESCRIPTION.

The major units of the RBA-7 equipment are a Navy type CFT-46154-B Receiver and a Navy type CBOG-21030-D Rectifier Power Unit. The two units are housed in separate shelf-mounting cabinets and connected together by means of appropriate cables and plugs.

*a.* NAVY TYPE CFT-46154-B RECEIVER. — The receiver will operate from either a single wire antenna

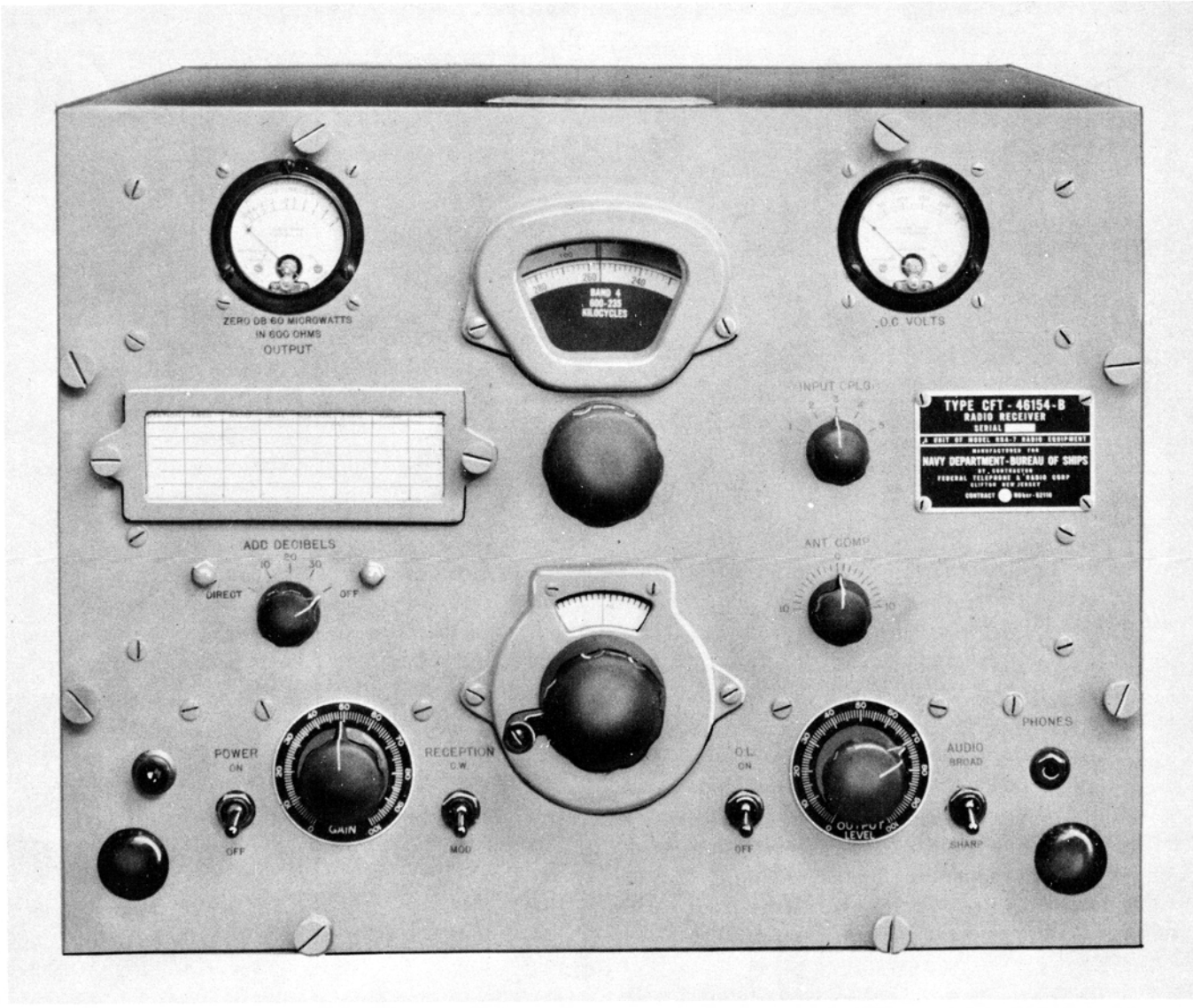



*Figure 1—2. Navy Type CFT-46154-B Radio Receiver*

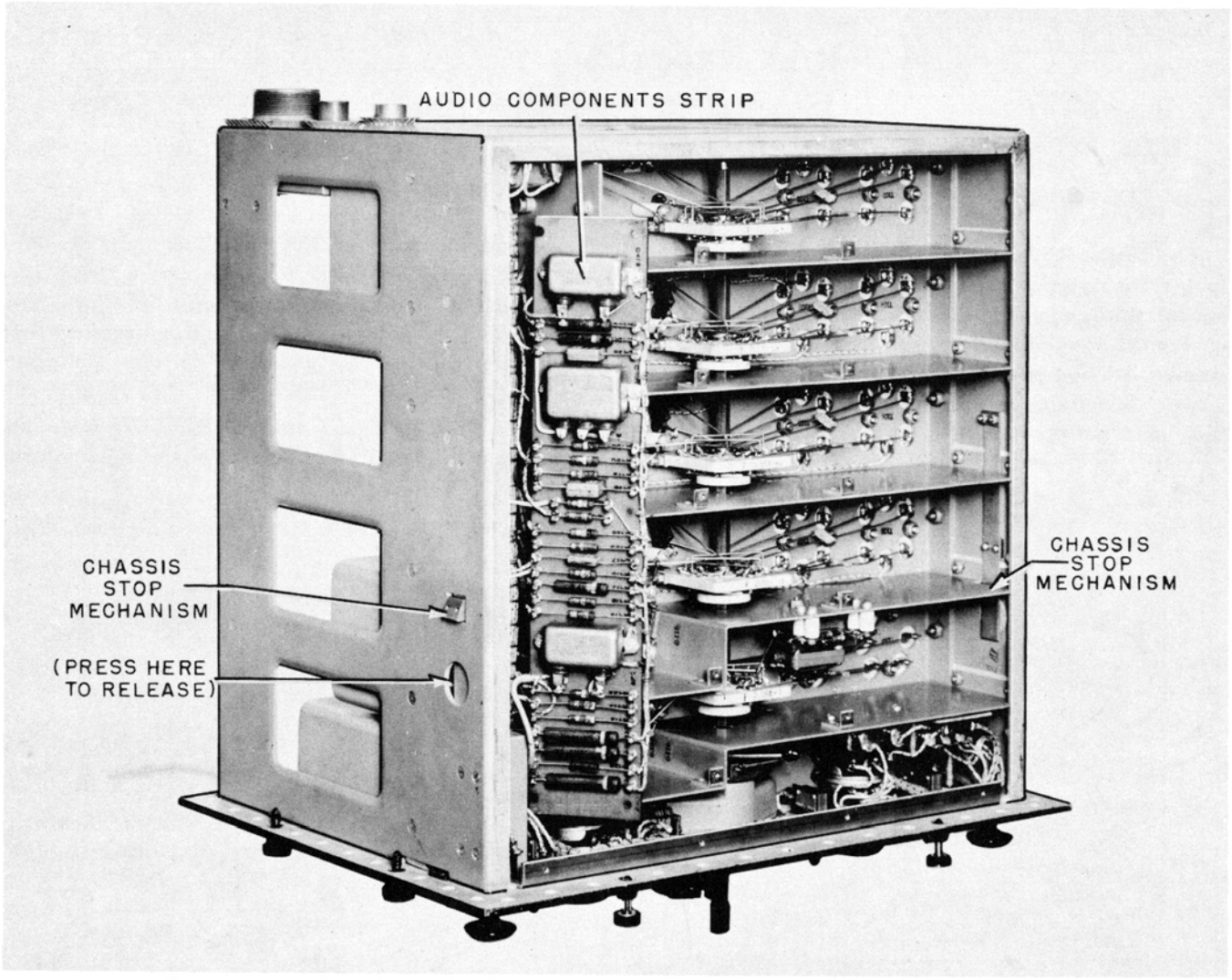



*Figure 1–3. Receiver Chassis, Bottom View, Showing Chassis Stop Mechanisms*

feed system or a coaxial line. The design is such that several receivers may be operated from one common feed system.

The receiver is commonly used with headphones; any number from 1 to 20 may be connected to the receiver output.

The receiver cabinet is a rectangular metal enclosure which provides both electrical shielding and mechanical protection for the electrical components. A front panel is secured to the cabinet by means of eight captive thumbscrews. These fastenings may be readily loosened to permit removal of the front panel and provide access to the receiver interior. The panel is rigidly supported on the front face of the chassis and therefore pulling out the panel automatically brings the chassis out forward. This forward travel of the chassis is limited by a chassis stop mechanism, shown in figure 1–3, which may be unlatched to permit complete removal of the chassis. The chassis stop otherwise permits the chassis to be pulled out only enough to afford access to the tubes.

All receiver controls are located on the front panel. Also located on the front panel are a d-c voltmeter and an output meter. The operator's headset jack is located on the front panel whereas the output line plug, for remote headphones, and all other external connectors are located on the rear apron of the chassis in such a manner that they project through openings in the back of the cabinet.

*b.* NAVY TYPE CBOG-20130-D RECTIFIER POWER UNIT. — The power unit for the receiver operates from a 110-, 115-, or 120-volt 55- to 65-cycle source to deliver all required voltages. In an emergency two receivers may be operated from a single

power unit. Operating potentials under these conditions are slightly lower. The complete electrical-mechanical description of this unit is given in Appendix 1, Section 9.

*c.* RACK-MOUNTING OPTION. — The Model RBA-7 equipment may be converted for rack mounting by exchanging the receiver shelf-mounting cabinet for a rack-mounting cabinet, Navy type -10349, per BuShips drawing RE-10J552, and by the addition of a mounting shelf, Navy type -10348-A, per BuShips drawing RE-10J554, for the power supply.

### 3. REFERENCE DATA.

*a.* NOMENCLATURE. — Navy Model RBA-7 Radio Receiver.

*b.* CONTRACT NUMBER AND DATE. — NObsr-52110, 6 December 1950.

*c.* CONTRACTOR. — Federal Telephone and Radio Corporation, Clifton, N. J., U. S. A.

*d.* COGNIZANT NAVAL INSPECTOR. — Assistant Inspector of Naval Material, 167 Prospect Street, Passaic, N. J.

*e.* NUMBER OF PACKAGES PER COMPLETE EQUIPMENT. — 2.

*f.* TOTAL CUBICAL CONTENT. — 6.2 cubic feet uncrated, 16.5 cubic feet crated; including equipment spares (estimated).

*g.* TOTAL WEIGHT. — 274 lbs uncrated, 362 lbs crated; including equipment spares.

*h.* FREQUENCY RANGE. — 15 to 600 kc.

*i.* FREQUENCY BANDS. — Four: 15 to 38 kc, 38 to 95 kc, 95 to 235 kc, 235 to 600 kc.

*j.* RECEIVER TYPE. — TRF.

*k.* RECEIVER OUTPUT. — 50 milliwatts into 600 ohms or 500 milliwatts into 30-ohm load. Output may be into any number of from 1 to 20 headphones.

*l.* TYPE OF RECEPTION. — $A_1$, $A_2$, $A_3$.

*m.* RECEIVER INPUT IMPEDANCE (ANTENNA). — High impedance or 72-ohm concentric transmission line.

*n.* RECOMMENDED ANTENNA ELECTRICAL CHARACTERISTICS.

(1) High impedance antenna: up to 400 micromicrofarads capacity.

(2) 72-ohm concentric transmission line (coaxial).

*o.* POWER SUPPLY CHARACTERISTICS.

(1) DESIGNATION. — Navy type CBOG-20130-D.

(2) MANUFACTURER. — National Electronics Laboratories, Inc., 1713 Kalorama Road, N. W., Washington 9, D. C.

(3) INPUT VOLTAGES. — 110, 115, or 120 v 55-65 cycles.

(4) CURRENT REQUIREMENTS. — 0.63 A (approx.) at 110 v, 0.60 A (approx.) at 115 v, 0.58 A (approx.) at 120 v. Power factor 95%.

*p.* HEAT DISSIPATION. — CFT-46154-B receiver 30 watts (approx.); CBOG-20130-D power supply 36 watts (approx.).

*q.* EQUIPMENT SIMILARITIES. — The RBA Radio Receiver Equipment has undergone minor component changes since its initial introduction as the Model RBA. Models RBA through RBA-3 are identical except for nameplate changes due to different contractual data. The contract for the Model RBA-4 Receiver was cancelled. The Model RBA-5 is identical to its predecessors except that a few component values are changed to conform with standard JAN nominal sizes. The Model RBA-6 is identical to the RBA-5 except that it is provided with a rack-mounting panel instead of a cabinet. The Model RBA-7 is essentially the same as the Model RBA-5 except that wherever practical resistor and capacitor sizes are changed to standard JAN values and other minor manufacturing changes have been made. With these facts in mind, this instruction book may be applied to all RBA Receiver Equipments. Components of the various models are interchangeable except that if R-153 is changed to the different value specified for another receiver, C-117 must also be changed to the value specified for that other receiver (the reactance/resistance ratio must remain unchanged). The use of W-type tubes, as specified for the RBA-7, is preferable for all models.

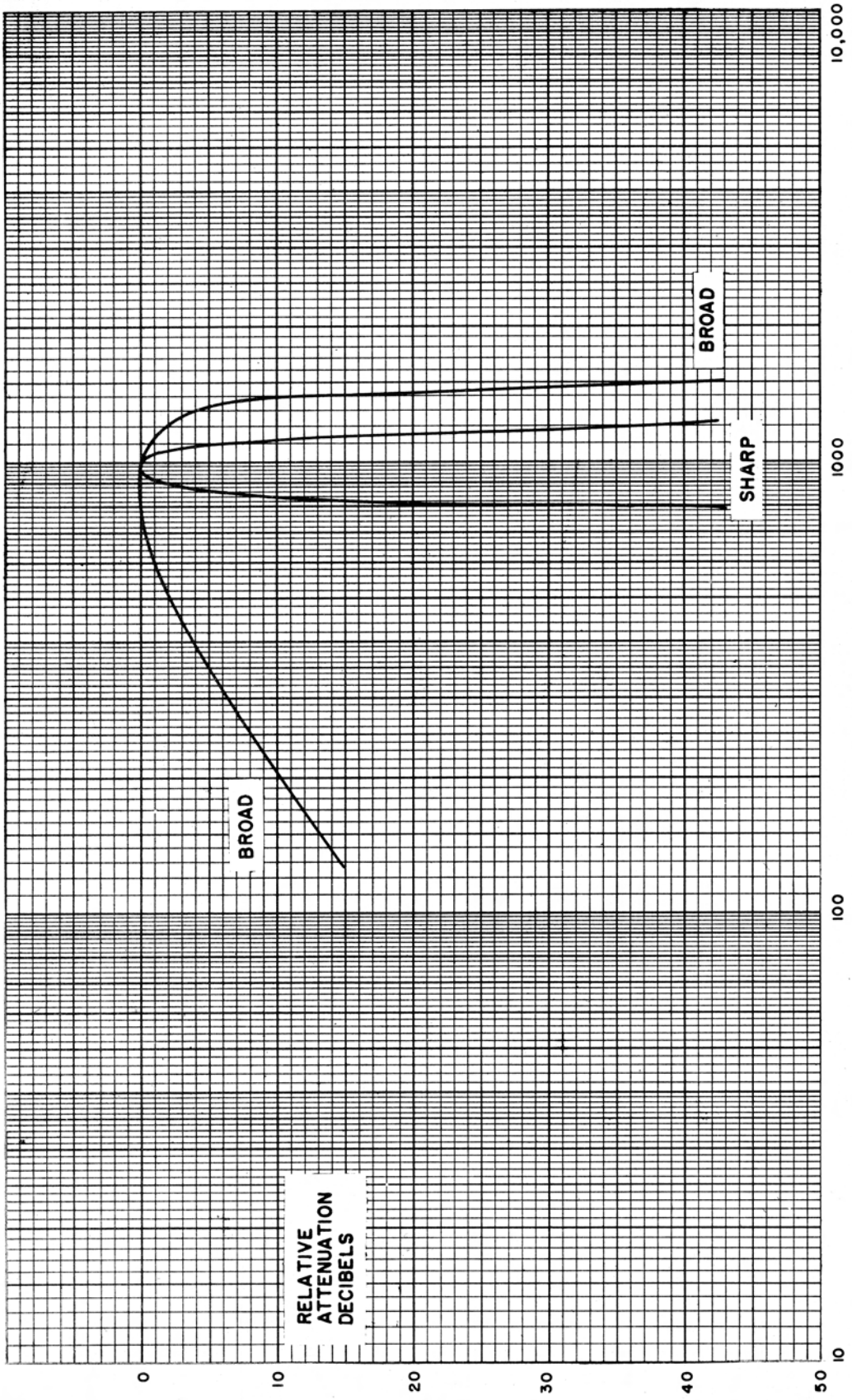



*Figure 2–5. Typical Frequency Response Characteristics, Audio Frequency Amplifier*

tuned circuits, producing a signal which is mixed with the received C-W carrier as it comes from the output of the R-F amplifier. The resultant 1,000-cycle difference product is later demodulated, in the detector, as an audible note.

The frequency of this electron-coupled oscillator is governed by one of four coils, which is switched into the circuit by the band switch, and by a section of the main tuning capacitor. The tuned frequency of the R-F amplifier is thus automatically tracked to produce the same beat tone* for all received C-W signals. Resonant absorption effects are prevented in this stage, as in all other stages, by shorting out the unused coil of the next lowest band. The output of the heterodyne oscillator is partially isolated, by means of resistor R-132, to prevent undue loading, and fed to the plate circuit of the third R-F amplifier. RECEPTION switch S-102 permits the oscillator to be disabled for reception of modulated signals.

Circuit features which depart slightly from the basic electron-coupled oscillator will be revealed by a study of the main schematic diagram, figure 7–16. It will be noted that the tuned elements of the various bands are not schematically identical. Each band has been individually adjusted by means of series or parallel capacitors for the correct LC ratio required for close tracking with the received signal. Where series capacitors are used the d-c path is maintained by means of shunt resistors (R-134 and R-135). Another feature of this oscillator is the output equalizing capacitor, C-119, which partially compensates for the increased output which normally occurs as the oscillator is tuned to the high end of each band. As the frequency increases the impedance of C-119 decreases, thus lowering the oscillator plate load impedance and decreasing the oscillator output.

Note also that the plate and screen voltages for the oscillator are supplied from the regulated 105-volt bus.

## 4. DETECTOR.

The output of the third R-F amplifier, mixed with the heterodyne oscillator output when required, passes directly into the detector. A triode detector, biased approximately to cut-off by means of a large value of cathode resistance, accomplishes the required demodulation by plate rectification. Plate current of this stage is varied only by the positive R-F excursions. Thus rectification and amplification both take place at the same time. Resistor R-147 and the combined 0.5-mf capacity of C-103C and C-104B form a hum filter in the B+ supply of this stage. Capacitor C-114 is an R-F bypass.

The link, E-101, connected between the cathode resistor and ground, may be opened to permit the insertion of a microammeter in the cathode circuit to indicate detector output when checking receiver selectivity.

## 5. WAVE FILTERS.

The detector output is modified by one of two wave filters, Z-101 or Z-102, to remove signals which do not contribute to the intelligence of the received communication. The broad and sharp audio response characteristics obtained from these wave filters are shown graphically in figure 2–5. The sharp characteristic is achieved by using a very narrow band-pass filter with a center frequency of 1,000 cps. This filter is particularly useful for reception of C-W signals ($A_1$ emission) as it will pass the 1,000-cps beat tone to the practical exclusion of all other signals and noise. The broad characteristic, obtained from the output of a sharp cut-off low-pass filter, is useful for reception of MCW ($A_2$ emission) as well as radio-telephone transmissions ($A_3$ emission). The low-frequency attenuation shown on the graph does not take place in this filter. Most of this attenuation takes place in the small output coupling capacitor, C-117, of the first A-F stage, V-107. Either filter may be used at will by manipulation of the AUDIO switch, S-103. The audio output at 1,000 cps is held at the same level for both switch positions by means of the T-pad arrangement R-112, R-122, R-113. The input and output impedance of both filters is 30,000 ohms.

## 6. AUDIO AMPLIFIER.

The audio amplifier of the RBA-7 receiver amplifies the detector output for delivery to the headsets. It is a three-stage voltage and power amplifier with two special features. An output level control (R-137) permits the overall audio output to be held at any desired level despite fluctuations of signal strength or modulation percentage. The behavior of this circuit is not to be confused functionally with that of the third R-F stage which limits the maximum carrier output presented to the detector. The output limiter control is to be adjusted by the operator to prevent uncomfortably high signal levels, which may occur at the louder peaks encountered when receiving fading signals, from blasting in the headphones. The fixed limiting inherent in the third R-F stage is provided to prevent overloading the detector.

The second design feature in the audio amplifier is the constant voltage output system which permits any number of headphones, from 1 to 20, to be switched in and out at will without noticeably changing the

*1,000 cps, ±0.75 percent of the signal frequency.

## TABLE 1–1. EQUIPMENT SUPPLIED

| QUANTITY PER EQUIPMENT | NAME OF UNIT | NAVY TYPE DESIGNATION | OVER-ALL DIMENSIONS* | | | VOLUME* | WEIGHT* |
|---|---|---|---|---|---|---|---|
| | | | HEIGHT | WIDTH | DEPTH | | |
| 1 | Radio Receiver | CFT-46154-B | 14-23/32 | 18⅛ | 20-9/16 | 3.2 | 98 |
| 1 | Concentric Plug for Connecting Transmission Line to Receiver | CFT-49121 | | | | | |
| 1 | Adapter for Connecting Antenna Lead-in to Receiver | CFT-49152 | | | | | |
| 1 | Output Plug for Receiver Output Receptacle | CFT-49160 | | | | | |
| 1 | Set of Mounting Hardware for Receiver | | | | | | |
| 2 | Instruction Books | | 11½ | 8⅞ | ½ | | |
| 1 | Audio Output Plug Adapter | CFT-49509 | | | | | |
| 1 | Set of Equipment Maintenance Parts | | 13¼ | 25¾ | 9-3/16 | 1.8 | 70 |
| 1 | Rectifier Power Unit | CBOG-20130-D | 13½ | 15 | 9¾ | 1.2 | 52 |
| 1 | Interconnecting Power Cable; Length, 6 feet | | | | | | |
| 1 | Power Input Plug for Power Unit | | | | | | |
| 1 | Set of Mounting Hardware for Power Unit | | | | | | |

*All dimensions are inches, volume cubic feet, weight pounds.

## TABLE 1–2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

| QUANTITY PER RECEIVER | NAME OF UNIT | NAVY TYPE DESIGNATION | REQUIRED USE | REQUIRED CHARACTERISTICS |
|---|---|---|---|---|
| 1 | Headset | | Output transducer for receiver | 600-ohm impedance |
| 1 | Headset Plug | | Connector for above headset | To mate with receiver PHONES jack, J101 |
| 1 | Antenna System | | Pick-up and transfer R-F signals to receiver | |

## TABLE 1–3. SHIPPING DATA

| SHIPPING BOX NO. | CONTENTS | OVER-ALL DIMENSIONS* | | | VOLUME* | WEIGHT* |
|---|---|---|---|---|---|---|
| | | HEIGHT | WIDTH | DEPTH | | |
| 1 | 1 — CFT-46154-B Radio Receiver<br>1 — CBOG-20130-D Rectifier Power Unit<br>2 — Instruction Books<br>1 Set — Plugs, Connectors, and Adapters | 22⅝ | 25⅜ | 40¼ | 13.4 | 270 |
| 2 | Equipment Maintenance Parts | 11½ | 27⅞ | 15⅜ | 3.1 | 92 |

*All dimensions are inches, volume cubic feet, weight pounds.

## TABLE 1–4. VACUUM TUBE COMPLEMENT

| UNIT | NUMBER OF TUBES OF TYPE INDICATED | | | | | |
|---|---|---|---|---|---|---|
| | 5U4 G | 6J5 WGT | 6K6 GT/G | 6SJ7 WGT | 6SK7 W | OC3W |
| Receiver | | 1 | 1 | 2 | 4 | |
| Rectifier Power Unit | 1 | | | | | 1 |
| Total Number of Each Type | 1 | 1 | 1 | 2 | 4 | 1 |

# SECTION 2
# THEORY OF OPERATION

## 1. GENERAL DESCRIPTION.

The Model RBA-7, Navy type CFT-46154-B, Radio Receiver is an eight-tube tuned radio-frequency communications receiver. It covers all radio frequencies from 15 to 600 kc. This tuning range is divided into four switch-selected bands with a five-percent overlap between adjacent bands. Receiver power is derived from a separate power supply which is described in Appendix I, a separate section of this book. The Navy Type CBOG-20130-D power supply provided with the RBA-7 receiver under this contract operates from a 115-volt a-c supply to deliver all required receiver voltages.

The receiver is functionally divided into a three-stage tuned R-F amplifier, a one-tube heterodyne oscillator, a triode detector, and a three-stage A-F amplifier. The heterodyne oscillator is employed to produce an audio beat tone for the reception of C-W signals.

The functional block diagram, figure 2–1, shows the arrangement of the receiver. The explanations which follow make reference to individual simplified schematics and to details shown in the main schematic diagram, figure 7–16.

## 2. TUNED R-F AMPLIFIER.

The three-stage tuned R-F amplifier utilizes four sets of tuned, band-switched coils; each set covers one of the four frequency bands. The coils used in each set are the antenna, 1st R.F., 2nd R.F. and 3rd R.F. stage coils. Thus there are 16 separate coils employed in the R-F tuning portion of the receiver.

*a.* INPUT CIRCUIT. — The receiver input is designed for connection to either a single-wire antenna system or to a coaxial feed line. Refer to the simplified schematic diagram, figure 2–2. The circuit is adjustable for peak performance with a wide variety of antennas. This same adjustment feature makes connection of several receivers to a common antenna system feasible.

Signal is fed into the receiver via the coaxial input jack J-102 and coupled, through INPUT CPLG. switch S-107, to a tap on the input coil via one of the coupling capacitors, C-141 to C-145, and static drain resistor R-133.

The antenna coil Q, for the two lowest band coils, is extremely high, as it also is on the low band coils of the other R-F stages. High Q circuits characteristically possess a great deal of electrical inertia; this inertia, or flywheel effect, causes the circuit to "ring", upon shock excitation (as encountered with the sharp signal transients of radio telegraphy), producing a damped oscillation which persists long enough to obscure the on-off state of a radio-telegraph transmitter. This undesirable effect, caused by high circuit Q, is eliminated by reducing the Q to an optimum value through the use of a damping resistor. The tuned circuits of all R-F stages are damped, on the two lowest bands, by the addition of a series damping resistor (R-142, figure 2–2, Simplified Schematic Diagram, Input Circuit); no damping is required on the two highest bands. Without damping the signal elements of transmitted radio-telegraph elements would blend together, in some instances making them unreadable. Static "crashes" would persist as a ringing sound and further obscure the received signal.

The four antenna coils, one for each band, are each fitted with a trimmer capacitor which permits separate alignment of each coil to be made. The antenna compensator, C-120, is a padder connected across the main tuning capacitor, C-135A, which permits corrective adjustment for different antenna capacitive loadings to make the antenna stage track with the succeeding tuned stages. This padder is a front panel control labeled ANT. COMP.

A protective neon lamp, V-101, limits the voltage across the antenna coil and thus protects the receiver against damage from excessive input voltages such as might result in the event of strong static bursts or unusually strong signals from nearby transmitters. Voltages in excess of approximately 90 volts cause the lamp to flash, effectively short-circuiting the input circuit for only as long as the strong signal persists. Normal operation is automatically restored with the removal of the excessive input voltage.

Several refinements to the simplified circuit are used in the receiver, as shown in the main schematic, figure 7–16. Four antenna coils are used, each selected in turn by the band switch. In addition, the coupling capacitor is changed, as required for different antenna loadings, by the operation of the INPUT CPLG. switch, S-107.

*b.* AMPLIFIERS. — The three R-F amplifiers are of similar design; each employs an identical coupling element consisting of an untuned primary coil inductively coupled to a tuned secondary. See figure 2–3,

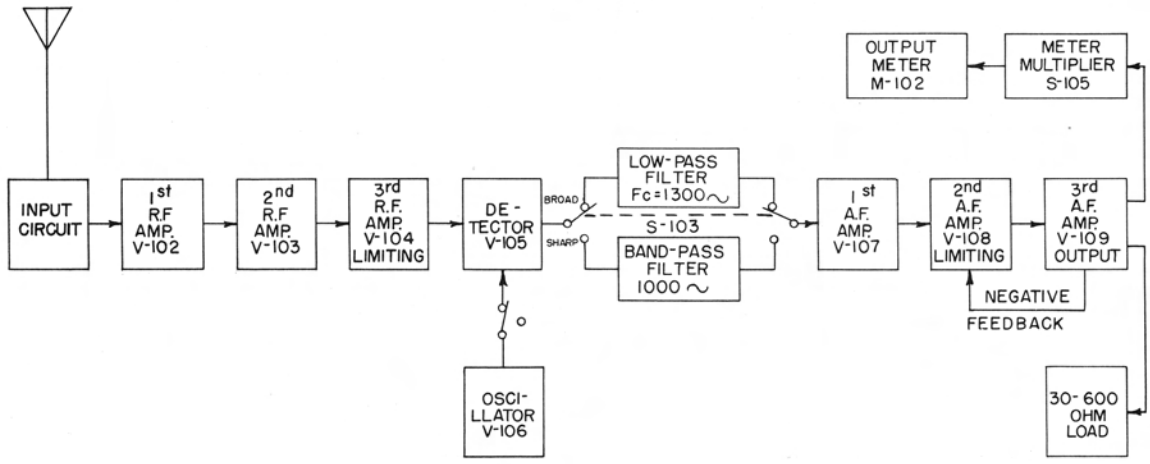



*Figure 2–1. Functional Block Diagram*

which is a simplified schematic of the first of three similar R-F stages. The band 1 and band 2 coils have damping resistors which are identical in function and design, for all three R-F amplifiers, to those used in the input circuit. Four coils are used for each stage; coils are paired in common shield cans, there being two shielded can assemblies for each stage. Thus the antenna, 1st, 2nd, and 3rd R-F stages and the oscillator stage each have a pair of coil assemblies, bringing the total number to 10. The band switch selects, by separate sets of contacts, the appropriate coil for each band. To prevent resonant absorption effects the band switch also shorts out the coil of the next lowest band. See figure 2–4, Band Switch Operation. The main tuning capacitor is a five-section ganged control which tunes all stages simultaneously. The individual stages are separately aligned for tracking by their respective fixed padder capacitors and the individual coils are likewise aligned by their adjustable trimmer capacitors. The trimmer capacitors are housed within the shield cans; the fixed padders are mounted under the chassis, below each ganged capacitor section.

The tuning dial has separate scales for each band. Only the applicable scale is in view, however, due to the action of a travelling mask which is moved by means of a mechanical connection to the band switch.

D-c voltages applied to each stage are supplied through decoupling resistors (R-107, R-108, and R-109) and RF filtered through bypass capacitors (C-101C, C-102C, and C-103B). The d-c voltages applied to the first and second R-F stages are identical. Refer to the main schematic diagram, figure 7–16. Cathode bias is developed across resistors R-101 and R-102. An additional, controlled bias voltage is developed across variable resistors R-128 and R-136A. These volume controls operate by varying the bias on the first and second stages, thereby varying the mutual conductance of the two tubes and controlling their gains. R-128 is a special volume control which is geared to the main tuning capacitor so that it decreases the gain as the receiver is tuned towards the high-frequency end of the dial. This decrease tends to automatically offset the increase of receiver gain occasioned as the tuning capacitance is decreased. The over-all gain of the receiver is thus held to a fairly constant level over any given wave band. The main R-F gain control, R-136A, is coupled to the audio gain control, R-136B, so that audio and R-F gains are ad-

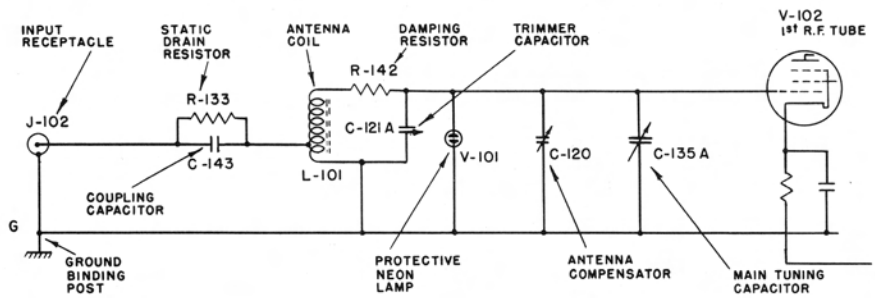



*Figure 2–2. Simplified Schematic Diagram, Input Circuit*

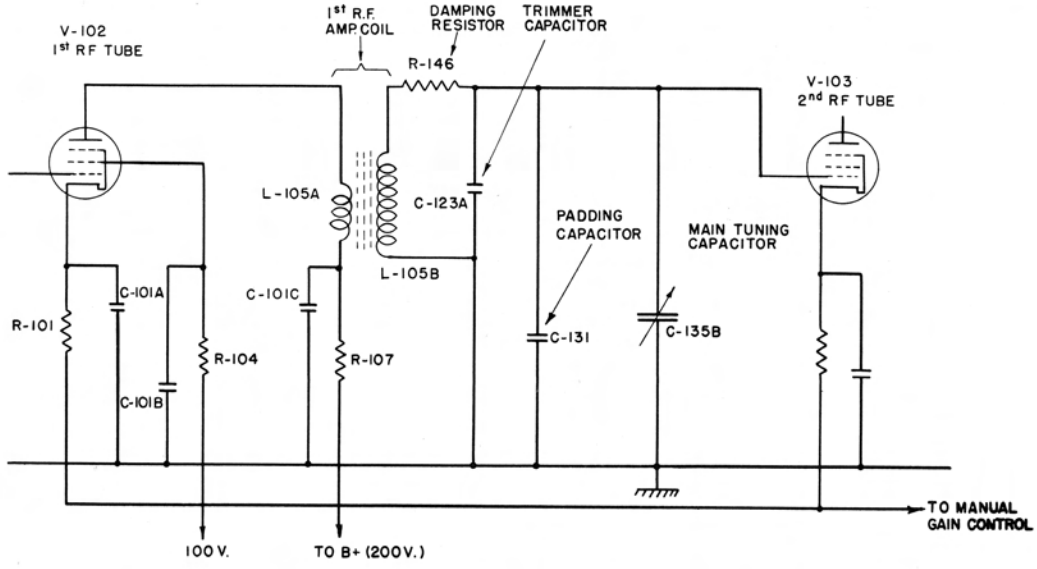



*Figure 2–3. Simplified Schematic Diagram, 1st R-F Amplifier Stage*

justed by the same control and maximum signal-to-noise ratio is obtained at all times. The gain control action of the two potentiometer sections is essentially consecutive rather than simultaneous. The two tapers have been deliberately adjusted to make the first 70 percent of clockwise rotation (0 to 70 on the dial scale) act principally to increase R-F gain while the remaining 30 percent (70 to 100 on the dial scale) will act primarily to increase A-F gain. In this manner tube microphonics receive maximum amplification only when the gain control is fully advanced and thus noises in the receiver are amplified only to the same relative degree as the signal and signal-to-noise ratio is always optimum.

The d-c voltages applied to the third R-F amplifier are considerably lower than those applied to the first two stages. Plate and screen potentials of approximately 15 volts limit the maximum output voltage of this stage to prevent overloading the detector. With voltages of this low order it is not practical to vary stage gain by control of the bias voltage; therefore the cathode of this stage is returned to ground through its bias resistor, R-103, without being connected to the volume control circuit. The behavior of this third R-F stage is not to be confused with automatic volume control. This circuit is purely an output limiter which behaves as it does because of its inherent inability to deliver more voltage to its output circuit than the dc that is available to its plate. Actual output voltage is somewhat less than half the applied d-c plate voltage.

### 3. HETERODYNE OSCILLATOR.

The heterodyne oscillator operates at a frequency of 1,000 cycles above the resonant frequency of the other

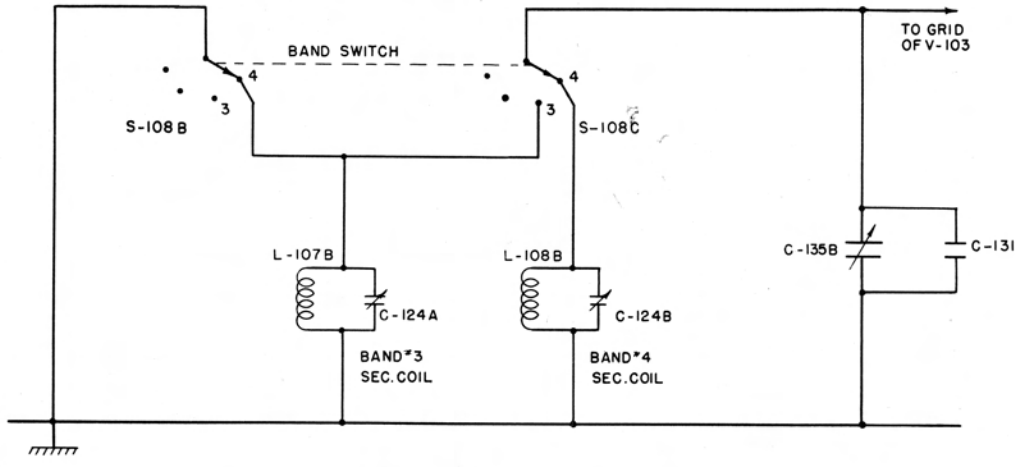



*Figure 2–4. Band Switch Operation, Band 4*

tuned circuits, producing a signal which is mixed with the received C-W carrier as it comes from the output of the R-F amplifier. The resultant 1,000-cycle difference product is later demodulated, in the detector, as an audible note.

The frequency of this electron-coupled oscillator is governed by one of four coils, which is switched into the circuit by the band switch, and by a section of the main tuning capacitor. The tuned frequency of the R-F amplifier is thus automatically tracked to produce the same beat tone* for all received C-W signals. Resonant absorption effects are prevented in this stage, as in all other stages, by shorting out the unused coil of the next lowest band. The output of the heterodyne oscillator is partially isolated, by means of resistor R-132, to prevent undue loading, and fed to the plate circuit of the third R-F amplifier. RECEPTION switch S-102 permits the oscillator to be disabled for reception of modulated signals.

Circuit features which depart slightly from the basic electron-coupled oscillator will be revealed by a study of the main schematic diagram, figure 7–16. It will be noted that the tuned elements of the various bands are not schematically identical. Each band has been individually adjusted by means of series or parallel capacitors for the correct LC ratio required for close tracking with the received signal. Where series capacitors are used the d-c path is maintained by means of shunt resistors (R-134 and R-135). Another feature of this oscillator is the output equalizing capacitor, C-119, which partially compensates for the increased output which normally occurs as the oscillator is tuned to the high end of each band. As the frequency increases the impedance of C-119 decreases, thus lowering the oscillator plate load impedance and decreasing the oscillator output.

Note also that the plate and screen voltages for the oscillator are supplied from the regulated 105-volt bus.

## 4. DETECTOR.

The output of the third R-F amplifier, mixed with the heterodyne oscillator output when required, passes directly into the detector. A triode detector, biased approximately to cut-off by means of a large value of cathode resistance, accomplishes the required demodulation by plate rectification. Plate current of this stage is varied only by the positive R-F excursions. Thus rectification and amplification both take place at the same time. Resistor R-147 and the combined 0.5-mf capacity of C-103C and C-104B form a hum filter in the B+ supply of this stage. Capacitor C-114 is an R-F bypass.

The link, E-101, connected between the cathode resistor and ground, may be opened to permit the insertion of a microammeter in the cathode circuit to indicate detector output when checking receiver selectivity.

## 5. WAVE FILTERS.

The detector output is modified by one of two wave filters, Z-101 or Z-102, to remove signals which do not contribute to the intelligence of the received communication. The broad and sharp audio response characteristics obtained from these wave filters are shown graphically in figure 2–5. The sharp characteristic is achieved by using a very narrow band-pass filter with a center frequency of 1,000 cps. This filter is particularly useful for reception of C-W signals ($A_1$ emission) as it will pass the 1,000-cps beat tone to the practical exclusion of all other signals and noise. The broad characteristic, obtained from the output of a sharp cut-off low-pass filter, is useful for reception of MCW ($A_2$ emission) as well as radio-telephone transmissions ($A_3$ emission). The low-frequency attenuation shown on the graph does not take place in this filter. Most of this attenuation takes place in the small output coupling capacitor, C-117, of the first A-F stage, V-107. Either filter may be used at will by manipulation of the AUDIO switch, S-103. The audio output at 1,000 cps is held at the same level for both switch positions by means of the T-pad arrangement R-112, R-122, R-113. The input and output impedance of both filters is 30,000 ohms.

## 6. AUDIO AMPLIFIER.

The audio amplifier of the RBA-7 receiver amplifies the detector output for delivery to the headsets. It is a three-stage voltage and power amplifier with two special features. An output level control (R-137) permits the overall audio output to be held at any desired level despite fluctuations of signal strength or modulation percentage. The behavior of this circuit is not to be confused functionally with that of the third R-F stage which limits the maximum carrier output presented to the detector. The output limiter control is to be adjusted by the operator to prevent uncomfortably high signal levels, which may occur at the louder peaks encountered when receiving fading signals, from blasting in the headphones. The fixed limiting inherent in the third R-F stage is provided to prevent overloading the detector.

The second design feature in the audio amplifier is the constant voltage output system which permits any number of headphones, from 1 to 20, to be switched in and out at will without noticeably changing the

*1,000 cps, ±0.75 percent of the signal frequency.

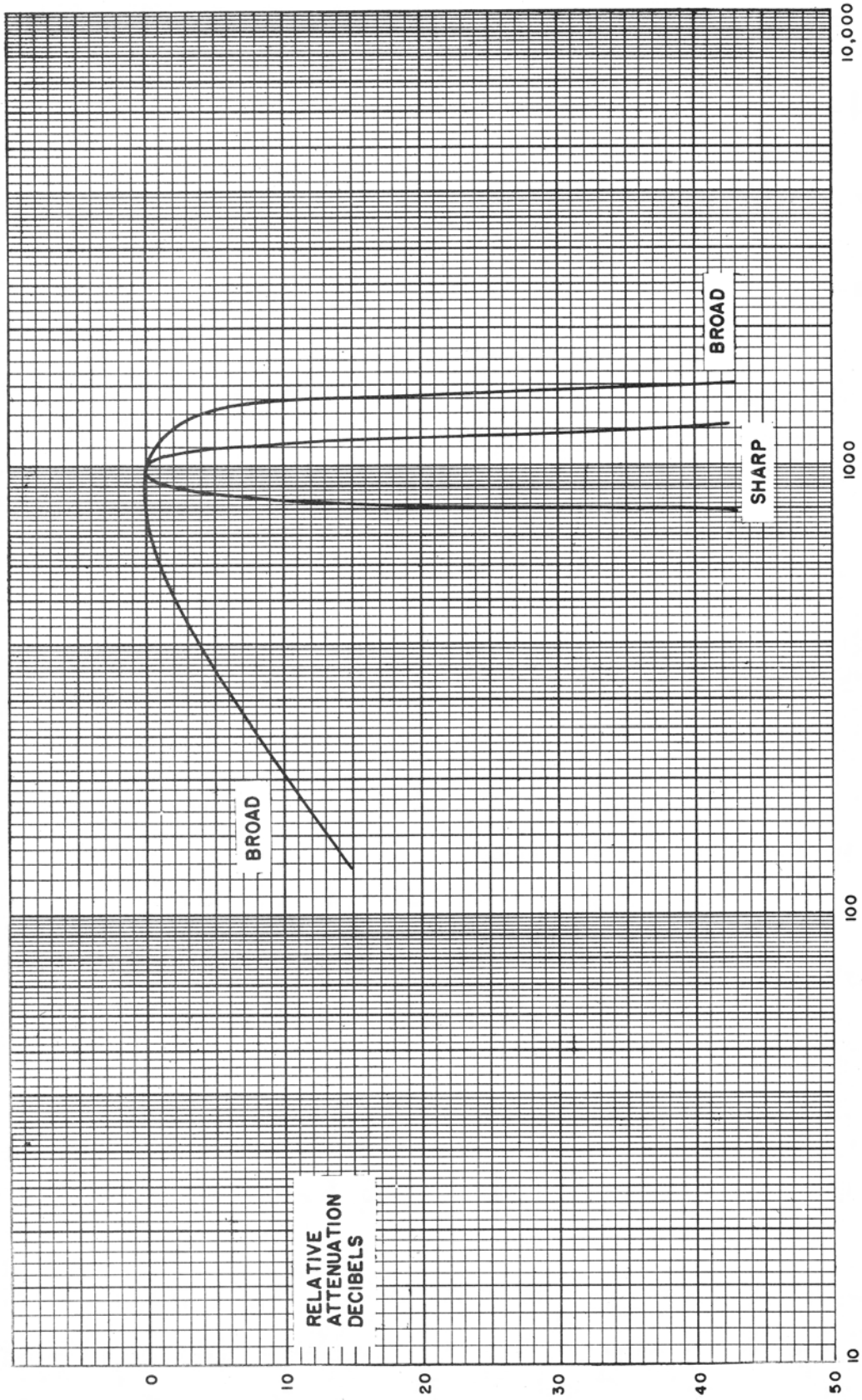



*Figure 2–5. Typical Frequency Response Characteristics, Audio Frequency Amplifier*

volume level in those headphones still in use. This is accomplished by the use of inverse feedback, as described below.

*a.* 1ST A-F AMPLIFIER. — The first audio stage is a conventional pentode voltage amplifier. It follows R-136B, the audio section of the manual GAIN control, and raises the detector output to a high level. The output of the first audio stage is coupled through a relatively small capacitor, C-117, to provide a desirable low-frequency attenuation of 6 db per octave below 500 cps.

*b.* 2ND A-F AMPLIFIER (OUTPUT LIMITER). — The second audio amplifier is similar to the first but has additional alternate connections for output limiting. The output limiter (O.L.) switch, S-104, provides the alternate facility of switching the second audio amplifier plate and screen supply through a variable potentiometer, R-137, the OUTPUT LEVEL control. With the reduced plate voltage supplied in this alternate switch position the maximum output voltage which the stage can develop may be limited to any desired degree within the range shown graphically in figure 2–6.

The cathode of this stage is left unbypassed so that a feedback return may be brought back to the cathode from the third A-F plate. The feedback circuit is discussed under 3rd A-F Amplifier, below.

*c.* 3RD A-F AMPLIFIER. — The third audio amplifier is a pentode power amplifier which is modified by inverse feedback to deliver nearly constant voltage output, for a given input voltage, despite large fluctuations of load impedance. With this feature any number of from 1 to 20 headphones may be connected to the output line with no more than 3-db total change of volume. Headphones may therefore be connected and disconnected at will without noticeably disturbing the volume level.

The explanation of the feedback circuit is as follows: Output from the plate of V-109 is brought out through separate feedback loops to the V-109 grid and the V-108 cathode. Both points are 180 degrees out of phase with the V-109 plate; therefore, the higher the voltage at the V-109 plate the greater the out-of-phase voltage applied to buck out the voltages being fed into both V-108 and V-109. The output voltage of V-109, without feedback, would increase as the load decreased. This increased output voltage, however, is applied to the feedback points where it tends to cancel a larger portion of the input signal voltage, thereby holding the output voltage down at almost the level obtained without the decreased load. The nominal amplifier output impedance, for purposes of measurement and test, is 600 ohms. Although a single 600-ohm headset will receive adequate power input when connected to the amplifier, maximum power transfer is arranged to take place when the maximum number of 20 headsets is in use. By this means the full rated power of the amplifier is available with the 30-ohm load presented by 20 headsets and power available to a single headset is limited by the impedance mismatch. Note that the effect of the mismatch on distortion is considerably offset by the large amount of feedback employed in this amplifier and that the correct match for maximum power transfer is less critical than in conventional pentode amplifiers.

*d.* OUTPUT CIRCUIT. — The output circuit of the audio amplifier is provided with two output windings, one for matching the power output to the headset and the other for providing adequate voltage to operate a volume indicator. Both secondary windings are electrostatically shielded from the primary to attenuate any RF which might be picked up in the receiver from the long output lines. Protection from R-F interference is further afforded by filters in the output connections of the load winding.

The output load winding is brought out, through separate R-F filters, to a headset jack and a three-contact socket for connection to the output line. This winding is center-tapped and balanced to ground. Output wiring and headset connections must, therefore, not be grounded.

The meter output winding does not have as great a step-down ratio as the load winding and thus the voltage available to the meter is made sufficiently high to provide adequate meter deflection, even with low audio output. The meter may be made less sensitive, when using higher output levels, by means of an ADD DECIBELS switch located on the front panel. Meter multiplication factors corresponding to 0, 10, 20, or 30 db may be selected by this switch. The 0-db position, labeled DIRECT, is spring-loaded so that the switch must be hand held in this position to obtain maximum meter sensitivity. The meter is thus somewhat protected from damage by excessive signal levels.

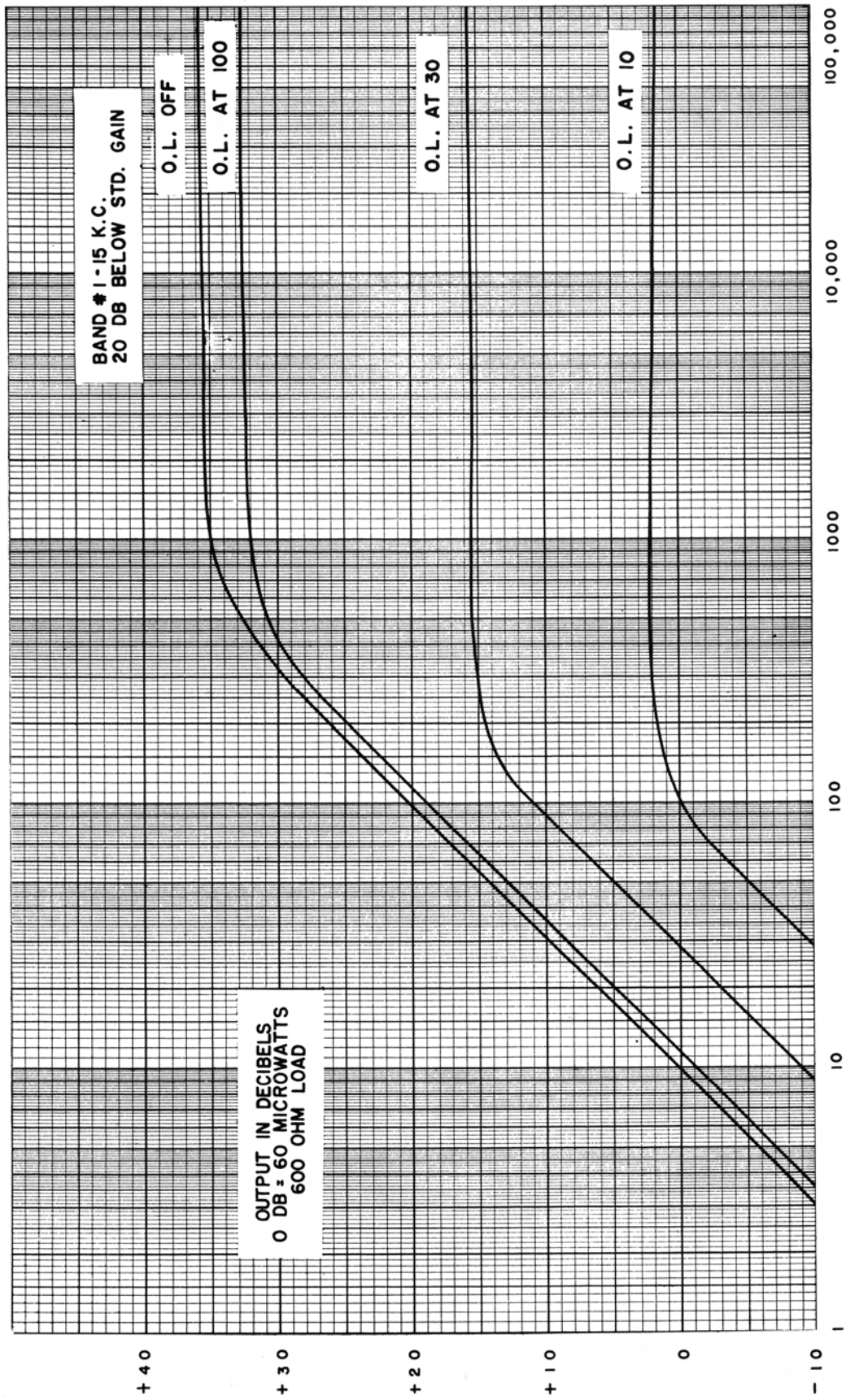



*Figure 2–6. Typical Resonant Overload and Output Limiter Characteristics*

# SECTION 3
# INSTALLATION AND INITIAL ADJUSTMENT

## 1. UNPACKING.

The RBA receiver and its power supply are packed in a wooden box, and the equipment spare parts in a separate crate. The following special precautions should be observed: Keep the box and crate in the upright position at all times. Observing the weights marked on the box and crate, make certain that appropriate lifting and transporting gear is used to handle the equipment. Avoid subjecting the equipment to shock or damage.

To unpack the equipment, the procedure given below should be followed:

*a.* RBA-7 RADIO RECEIVER AND CBOG-20130-D RECTIFIER POWER UNIT.

(1) Clip the metal bands that bind the wooden box.

(2) Remove at least two sides and an end from the box with a nail puller.

**CAUTION**

Do not use a hammer or pinch bar for this purpose.

(3) Remove the two P-shaped wood details used for holding the inner cartons in place.

(4) Remove the instruction books which are enclosed in envelopes on top of the larger carton.

(5) Tear open the flaps of the larger outer carton, in which the RBA-7 Receiver is packed, thus exposing the vaporproof foil barrier which surrounds an inner carton.

(6) Extract the barrier-packed inner carton from the outer carton.

(7) Tear open the barrier and open the flaps of the inner carton.

(8) Remove the top insert.

(9) Remove the paper bag containing interconnecting connectors and installation hardware; this bag is packed in one of the pockets of a side insert. Remove all bags of desiccant from the side inserts.

(10) Remove the side inserts.

(11) Remove the RBA-7 Receiver.

(12) Remove the wood blocking at the front and back of the receiver.

(13) Open the flaps of the outer carton, which contains the rectifier power unit.

(14) Remove the inner carton, which is enclosed with a vaporproof barrier.

(15) Tear open the vaporproof barrier.

(16) Open the flaps of the inner carton containing the rectifier power unit.

(17) Remove the top insert containing the power unit accessories.

(18) Remove all bags of desiccant from the side inserts.

(19) Remove the side inserts.

(20) Remove the rectifier power unit.

*b.* EQUIPMENT SPARE PARTS.

(1) Clip the metal bands that bind the crate.

(2) Remove at least three sides from the crate with a nail puller.

**CAUTION**

Do not use a hammer or pinch bar for this purpose.

(3) Tear open the sealed waterproof crate liner and remove the corrugated paper wrapping from the equipment spare parts box.

(4) Remove the spare parts box.

**Note**

Do not open the metal spare parts box until the parts it contains are ready for actual use or installation.

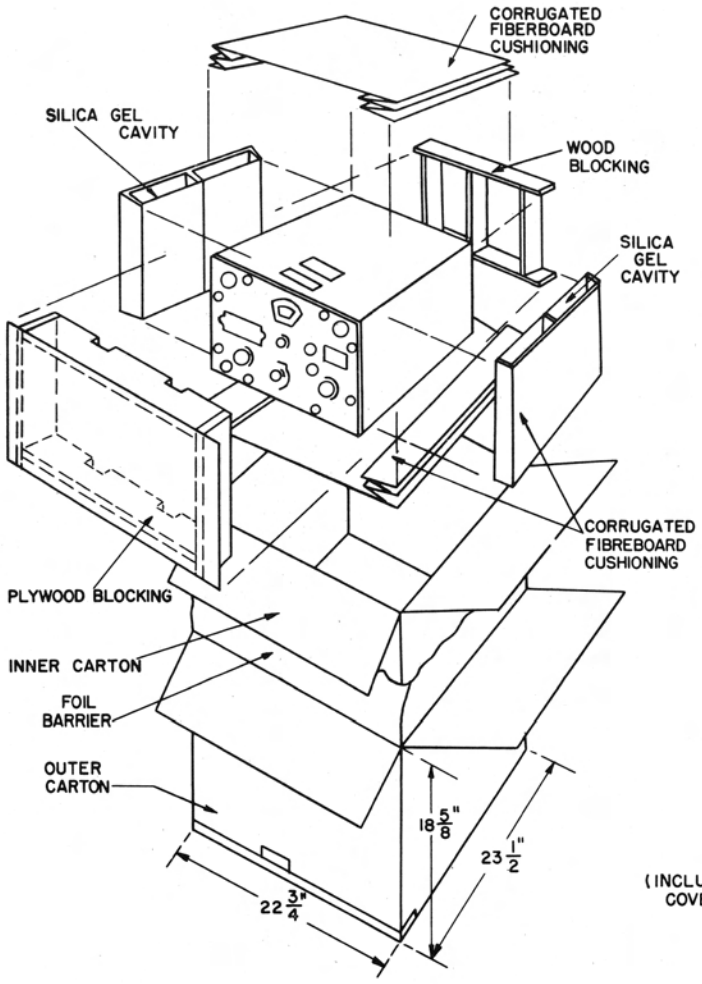
## 2. MOUNTING DETAILS.

If required, the equipment may be rack mounted; instructions are given in Section 1, paragraph 2*c*, on page 1–3.

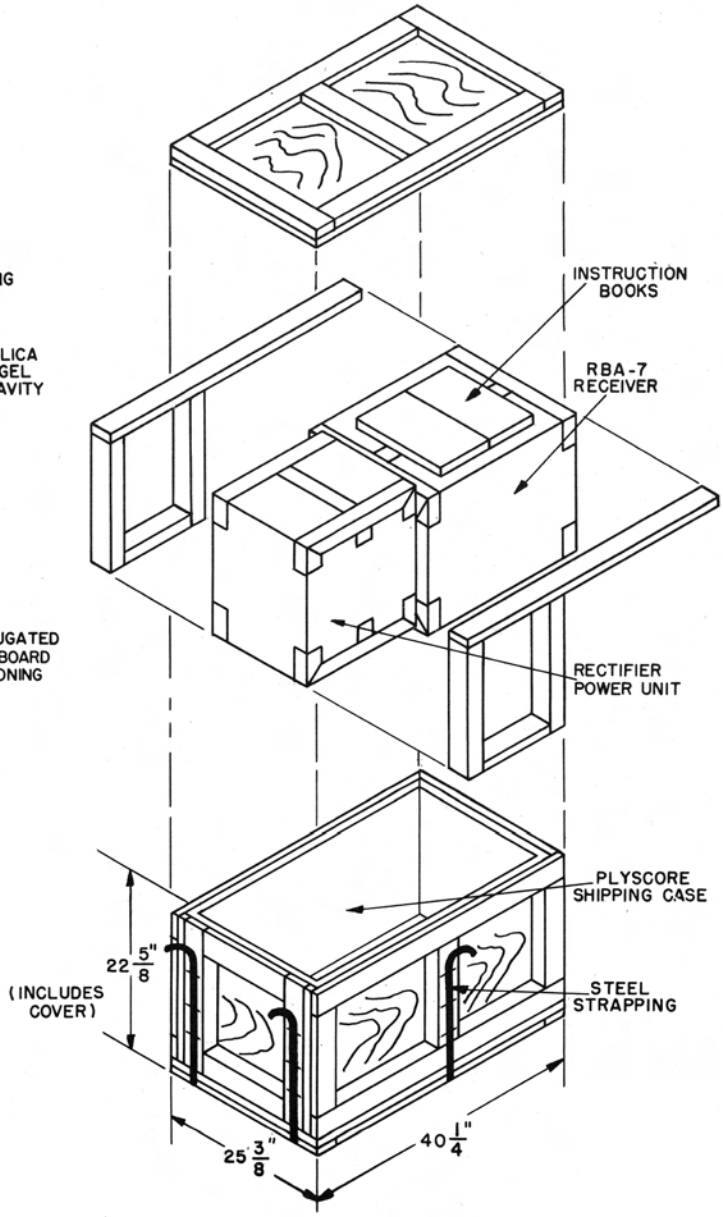
Refer to the supplement for the Rectifier Power Unit, Section 3 of Appendix I, page 9–4, for installation instructions for that unit.

The following mounting hardware is furnished with each RBA-7 receiver:

Four 5/16″–18 cap screws
Four spring lockwashers
Four 1-3/4″ x 3/8″ flat washers
Four 5/16″–18 nuts

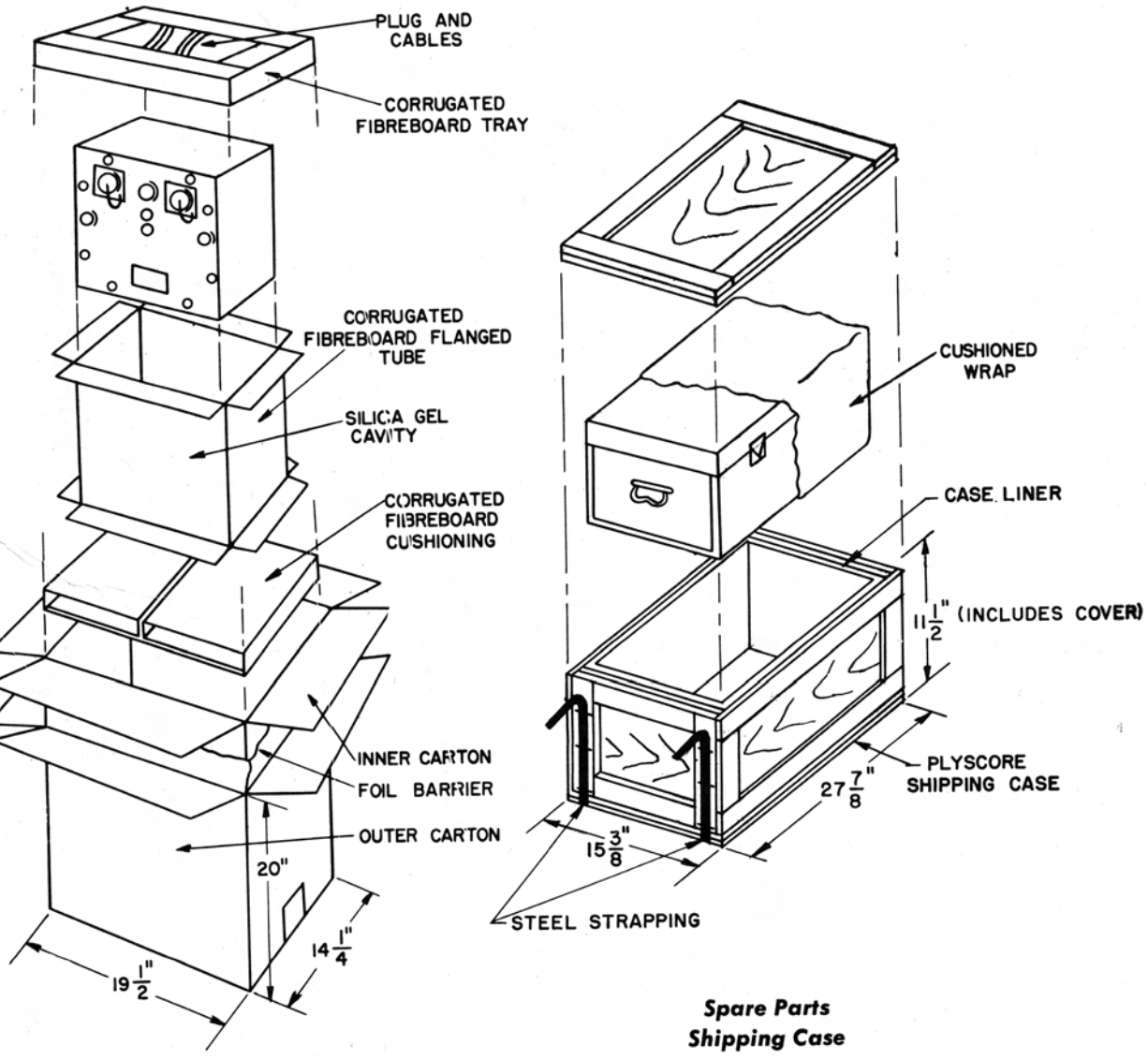



*CFT-46154-B*
*Radio Receiver*
*Packed in Carton*




*CFT-46154-B*
*Radio Receiver and*
*CBOG-20130-D Rectifier*
*Power Unit Packing*
*Cartons in Shipping*
*Case*

*Figure 3—1a. RBA-7 Radio Receiver Equipment, Unpacking Procedure*




***CBOG-20130-D***
***Rectifier Power Unit Packed in Carton***

***Spare Parts Shipping Case***

***Figure 3—1b. RBA-7 Radio Receiver Equipment, Unpacking Procedure***

Figure 3–2 shows the outline and mounting dimensions of the RBA-7 receiver. To mount the receiver, proceed as follows:

*a.* Remove any plugs which may be attached to the receptacles at the rear of the cabinet. (The receptacles should not be confused with the plugs. The receptacles are permanently attached to the receiver chassis and protrude through the rear of the cabinet; the chassis cannot be withdrawn until the mating plugs are disconnected.)

*b.* Unscrew the eight captive thumbscrews holding the panel to the cabinet.

*c.* Withdraw the chassis from the cabinet, using the two metallic knobs located at the sides near the bottom of the panel (control knobs should not be used for this purpose). After the chassis has been drawn forward approximately six inches, its movement will be blocked by the stop mechanism located at each side near the bottom of the chassis (see figure 1–3). Disengage these stops by depressing the stop springs, accessible through holes in the side of the chassis, and remove the chassis from the cabinet.

*d.* Secure the cabinet to the operating table through the medium of the four shock mountings, employing the machine screws and other hardware listed above.

*e.* Make sure that all vacuum tubes are well-seated in their respective sockets.

*f.* Replace the chassis in the cabinet, and tighten securely the eight panel thumbscrews.

### 3. CABLE CONNECTIONS.

*(See figure 3–2.)*

*a.* GENERAL. — The three receptacles protruding through the rear of the cabinet are employed for connection to the input (antenna or concentric transmission line), output (a two-conductor shielded line) and to the Interconnecting Power Cable. In normal installations, the receiver input connection will be made through a concentric shielded line. In order to reduce interference from strong radio-frequency fields, it is important that the three shielded cables and ground lead attached to the receiver be bunched together, and run as close as possible to the receiver cabinet and other grounded surfaces.

*b.* INTERCONNECTING POWER CABLE. — With the CF3OG-20130-D Rectifier Power Unit disconnected from the a-c power line, plug the Interconnecting Power Cable into the mating receptacle, J-104, of the receiver and secure the plug by means of its knurled coupling ring, turning this ring clockwise as far as it can be turned by hand. (Wrenches should not be employed for this purpose.)

*c.* INPUT CONNECTION. — The type -49120 Input Receptacle, J-102, of the receiver is designed for mating the type -49121 Concentric Plug and the type -49152 Adapter, both of which are furnished with the

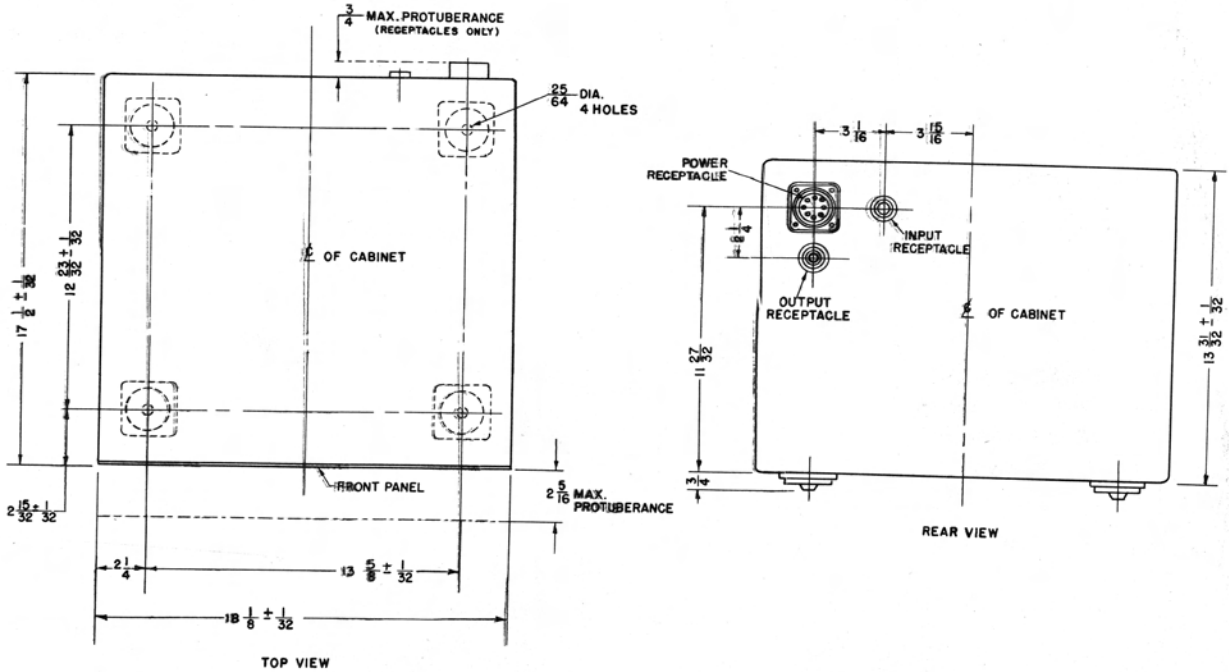



*Figure 3–2. CFT-46154-B Receiver in Cabinet, Outline Drawing*

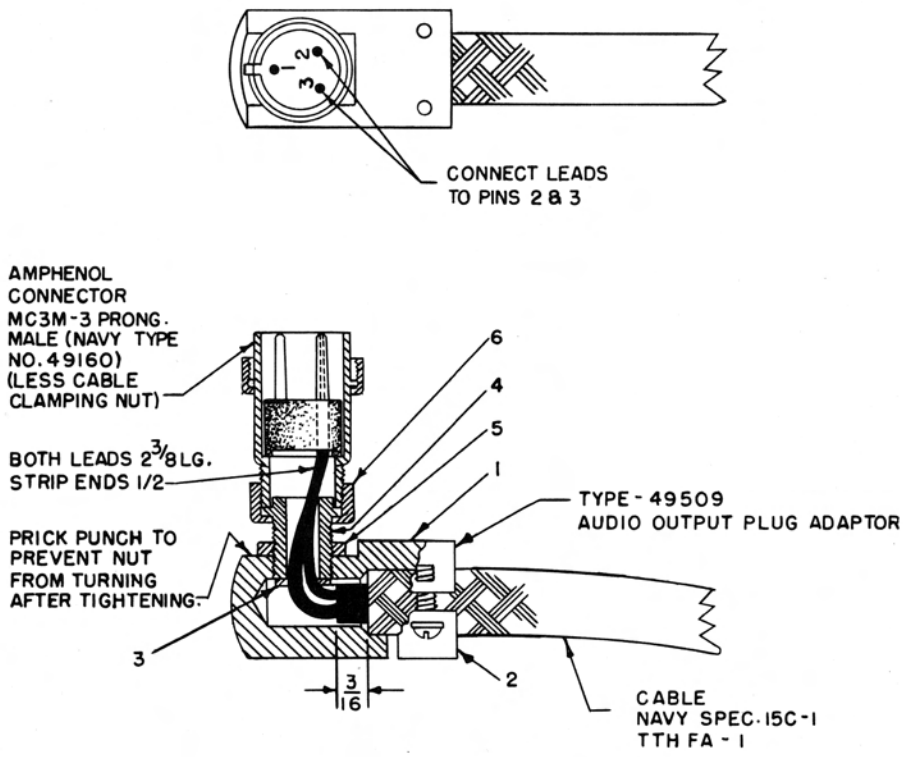



***Figure 3–3. Output Plug Connection***

receiver. If the input connection is made through a concentric transmission line (or patch cord), the line or cord should terminate in the type -49121 Concentric Plug. If direct connection to an antenna is to be made, the -49152 Adapter is employed in lieu of the Concentric Plug. The Adapter is fitted with a binding post to which the antenna lead-in is to be connected.

*d.* OUTPUT CONNECTION. — The receiver output is available at the telephone jack on the front panel for connection of the operators' headsets and at the output receptacle, J-103, at the rear of the chassis for connection of remote headsets. A type -49160 three-pin plug is supplied with the receiver to mate with J-103. A type -49509 Audio Output Plug Adapter is also furnished with the receiver for the purpose of joining Navy type TTHFA-1 cable to the type -49160 plug. Neither side of the two-conductor output cable should be grounded, since the center tap of the load winding in the output transformer is grounded in the receiver.

To install the Audio Output Plug and Adapter, proceed as follows (see figure 3–3):

(1) Remove the cable clamping ring furnished with the type -49160 plug.

(2) Strip the ends of the two conductors ½ inch as shown in figure 3–3.

(3) Insert the cable into the connector body (1) and pull the two conductors through the tapped hole in the body.

(4) Clamp the cable in place with the clamp (2). Two machine screws and lockwashers are furnished for this purpose.

(5) Insert the insulating washer (3) over the two conductors and into the bottom of the tapped hole in the connector body (1).

(6) Assemble the bushing (4), locknut (5), coupling nut (6), and Plug -49160. Insert the conductor leads into pins No. 2 and No. 3 of the plug.

(7) Before tightening the locknut (5) note positions of the key and connections. Be sure that the positions agree with figure 3–3. Tighten the locknut (5).

(8) Prick-punch the connector body adjacent to the locknut (5) to prevent it from turning.

(9) Solder leads to pins No. 2 and No. 3, applying solder at the pin tips. Cut the leads flush with the pin tips. Remove excess solder and rosin. (Note: Pin No. 1 is not used.)

(10) Secure the plug to its mating chassis receptacle by means of the knurled coupling ring.

*e.* GROUND CONNECTION. — A binding post is provided at the rear of the cabinet. This should be connected to the best available ground, through the

shortest practicable route, by a heavy copper conductor (#12 or #14 B & S gauge) or by copper braid (⅜ inch or ½ inch wide). A low impedance ground connection is desirable in order to reduce interference from strong radio-frequency fields. It will be helpful to group the ground lead, in so far as is practicable, with the shielded cables leading from the receiver.

## 4. INITIAL ADJUSTMENTS.

*a.* Plug a 600-ohm headset into the phone jack on the receiver.

*b.* Turn the POWER switch OFF; place the RECEPTION switch in the C.W. position; turn the GAIN control to 0; place the O.L. (output limiter) switch in the OFF position; place the AUDIO (filter) switch in the BROAD position; place the ADD DECIBELS switch in the OFF position; turn the INPUT CPLG. switch to position 5 (maximum coupling).

*c.* Having made sure that vacuum tubes are in the proper sockets in the power unit and receiver, plug the input cable of the power unit into the a-c power line and turn the equipment ON by means of the POWER switch on the receiver panel. The d-c voltmeter (D.C. VOLTS) should read approximately 200 volts after a short warm-up period.

*d.* Adjust the wave-band switch to the desired range. The band switch is controlled by means of the large knob directly beneath the dial window. The range in use is indicated by the frequency limits engraved on the travelling dial mask.

*e.* Adjust the main tuning control (the knob fitted with a crank) until the receiver is tuned to the desired frequency (preferably near the high-frequency limit of a frequency band for this initial adjustment) as indicated by the frequency calibrated dial. The vernier tuning dial calibration and the calibration of the outer scale of the main tuning dial are in arbitrary units which do not directly indicate frequency.

*f.* Turn the GAIN control clockwise until a rushing noise (receiver background noise) of a comfortable level is heard in the headset.

*g.* Adjust the tuning control back and forth slightly until the desired signal is picked up. If a beat note is heard on both sides of resonance, adjust for the louder beat note, adjusting for approximately a 1,000-cps tone.

*h.* Having tuned in the signal as described above readjust the gain control for a low output level. Adjust the ANT. COMP. to resonance as indicated by maximum signal strength, with the signal strength dropping sharply at each side of the resonant position. If this condition cannot be obtained turn the INPUT CPLG. switch to position 4 and again slowly rotate the ANT. COMP. throughout its range. If unsuccessful try positions 3, 2 and 1, in turn, of the INPUT CPLG switch. For direct-connected antennas the operator should employ the highest setting of the INPUT CPLG. switch which will permit resonating the ANT. COMP.; position 3 will be employed for very large antennas, and position 4 or 5 for average antennas. When employing transmission line input the operator should use that position of the INPUT CPLG. switch which provides maximum signal strength, unless interference is unusually severe. When severe interference is encountered it may be desirable to loosen the input coupling to improve selectivity. Maximum sensitivity for transmission line operation will usually be found on position 3; positions 1 and 2 provide looser coupling, with some loss in sensitivity, but with a gain in selectivity which may be appreciable for some types of transmission lines. In general, after having once adjusted the INPUT CPLG. switch for a given input system, it will be necessary to readjust it for that input system only on occasions when decreased coupling is desirable to improve selectivity. If the ANT. COMP. is adjusted at the upper end of any frequency band in the receiver, readjustment of this control is seldom required at any other frequency in that band. An exception to the above generalization occurs if the input system incorporates a transformer for coupling the antenna to the transmission line. Considerable readjustment of both the INPUT CPLG. and ANT. COMP. may then be required at certain critical frequencies.

# SECTION 4
# OPERATION

## 1. GENERAL.

Having made the initial equipment adjustments described in Section 3* and having tuned in a signal, the operator may employ several design features which will be found useful for various receiving conditions. The operation of these devices is described in this section. Refer to figure 4–1 for location of controls.

## 2. RECEPTION SWITCH.

For reception of $A_2$ and $A_3$ signals the RECEPTION switch should be placed in the MOD. position, thereby turning off the heterodyne oscillator. The initial tuning adjustments for weak signals of this class may be facilitated, however, by placing the RECEPTION switch in the C.W. ($A_1$) position.

## 3. AUDIO SWITCH.

This switch permits the selection of a low-pass filter in the BROAD position and a narrow band-pass filter in the SHARP position. When attempting to receive $A_3$ signals, this switch should be in the BROAD position. Voice intelligibility will be very poor, since the filter cuts off at approximately 1,300 cps. The BROAD position should likewise be employed for the reception of $A_2$ signals unless the modulation frequency happens to coincide with the center of the passband of the sharp filter (1,000 cps). The BROAD position should be employed in the initial tuning adjustments for the reception of $A_1$ signals and for stand-by operation. When preparing to "copy" a message, however, the switch should be in the SHARP position and the signal beat note should be carefully adjusted by means of the main tuning control for maximum volume. Maximum volume will occur when the beat note frequency coincides with the center of the passband of the SHARP filter. This filter will effectively remove interfering signals which differ by only a few hundred or more cycles from the frequency of the desired signal. At the lower radio frequencies (15 to 60 kc) the SHARP filter will be found especially useful in increasing the effective selectivity of the receiver. When ad-

*The adjustments described in Section 3, paragraphs *4d* through *h*, are required each time a new signal is tuned in.

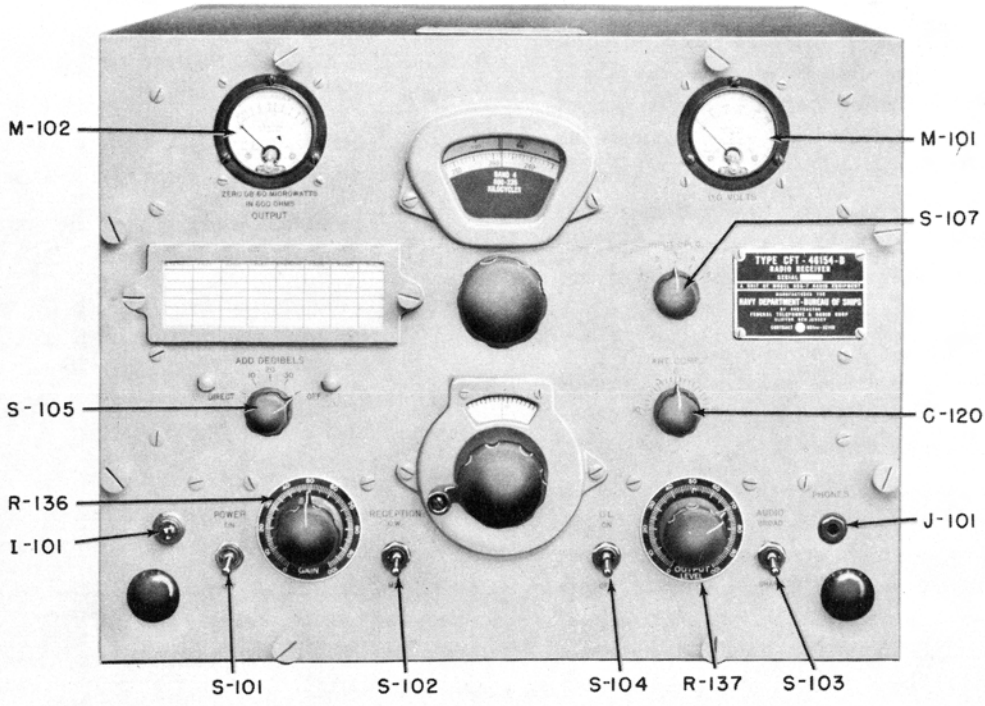



*Figure 4–1. Navy Type CFT-46154-B Radio Receiver, Front Panel Controls*

justing the beat note to the center of the filter passband the signal volume should be kept low and the output limiter should be turned off in order to avoid inaccurate tuning due to overload conditions.

**4. OUTPUT LIMITER.**

The output limiter is a device which permits control of the level to which the receiver output may rise, regardless of the strength of the incoming signal. This feature is primarily useful as a protective device, since the operator can adjust the output level of the signal to a comfortable value and will be assured that static crashes and strong interfering signals will not develop a blasting volume with the receiver set for the desired signal, even though the interfering signals may be many times stronger than the desired signal at the receiver input terminals. The limiter is also very useful when tuning over a wide frequency band, searching for signals, as it limits painfully loud signals; its use is also advised for stand-by operation for the same reason. It should not be employed when making accurate tuning adjustments as it has the effect of broadening resonance indications. The output limiter may be turned on or off by means of the O.L. switch; the output level is adjusted by means of the adjacent OUTPUT LEVEL control. The maximum output level which the receiver is capable of attaining increases as this control is turned clockwise.

The adjustment of the output limiter should proceed as follows:

*a.* With the O.L. switch in the OFF position complete the fine tuning adjustments by peaking the ANT. COMP. and the main tuning control for maximum signal output volume. Adjust the gain control for comfortable headset volume.

*b.* Place the O.L. switch in the ON position and, starting with the OUTPUT LEVEL control at 100, slowly turn this control until the output level drops slightly.

*c.* Now increase the setting of the GAIN control until the output level reaches a point where further increase in the GAIN control setting does not cause an appreciable increase in output.

*d.* Decrease the setting of the OUTPUT LEVEL control until the desired output level is reached. If too much background noise (rush, etc.) is heard between signal elements, turn down the GAIN control until the noise is no longer objectionable. If this adjustment reduces the output level too much, compensate for it by increasing the setting of the OUTPUT LEVEL control. After some experience in operating the receiver the operator will learn the scale position of the OUTPUT LEVEL control fixing the most desirable headset volume level; this will probably be between 10 and 20 on the scale. He will thereafter turn the OUTPUT LEVEL control to this position and advance the GAIN control to a point just below that at which the background noise becomes objectionable.

**5. OUTPUT METER.**

The OUTPUT meter is most useful to the operator as a tuning indicator. The OUTPUT meter and the ADD DECIBELS switch may be employed to measure the output of the receiver in milliwatts PROVIDED THE RECEIVER IS OPERATING INTO A 600-OHM LOAD. For loads other than 600 ohms the error is approximately inversely proportional to the change in load resistance. To measure the output level of the receiver proceed as follows:

*a.* Make sure that the load resistance is 600 ohms. The output receptacle in the rear of the receiver and the telephone jack are connected in parallel; thus the effective load resistance will be equal to the parallel combination of the loads connected at these two points.

*b.* Starting with the ADD DECIBELS switch in the OFF position turn this switch counterclockwise until a meter reading is obtained, preferably between –5 db and +5 db. Add the reading of the ADD DECIBELS switch to the reading of the OUTPUT meter to obtain the output level in decibels. Examples:

(1) The meter reads +3 and the ADD DECIBELS switch reads 20: the output level is 20 + 3 = 23 decibels.

(2) The meter reads 0 and the switch reads 20: the output level is 20 + 0 =20 decibels.

(3) The meter reads –3 and the switch reads 20: the output level is 20 + (–3) =20 – 3 = 17 decibels.

(4) The meter reads +3 with the switch in the DIRECT position: the output level is +3.

*c.* If desired, the output level in decibels may be converted into power. Examples:

(1) The meter reads 0, with the switch in the DIRECT position: as indicated by the engraving directly under the meter, 0 db = 60 microwatts.

(2) The output level is 20 decibels: 20 decibels corresponds to a power ratio of 100/1; that is, the power level is 100 times as great as the reference level (60 microwatts). Therefore the power output is 100 x 60 microwatts, or 6,000 microwatts. Since 1,000 microwatts = 1 milliwatt, 6,000 microwatts = 6 milliwatts; thus the output level is 6 milliwatts, or 6 mw.

**CAUTION**

The ADD DECIBELS switch should always be left in the OFF position, when not using the output meter, to guard against meter damage due to strong signals.

*d.* Do not turn the ADD DECIBELS switch to the DIRECT position if the meter reads higher than –5 decibels with the switch in the 10 position. In the DIRECT position the meter is easily burned out by strong signals; for this reason a spring mechanism is incorporated in the switch design, making it necessary to manually hold the switch in the DIRECT position.

## 6. MAIN TUNING DIAL CALIBRATION.

The accuracy of the frequency calibration of the main tuning dials is ±1 percent.

The outer scale of the main tuning dial is designed to be read in conjunction with the scale of the vernier dial attached directly to the main tuning control knob. These two scales do not directly indicate frequency but are employed to subdivide the range of the main tuning control into 1,000 equally spaced divisions for logging purposes. The vernier dial is divided into 100 divisions; 10 revolutions of the vernier dial will cover the complete tuning range. In reading the two dials, for logging purposes, add the next lowest reading of the main dial scale (ignoring odd multiples of 50) to the reading of the vernier dial. Examples:

*a.* The vernier dial reads 32 and the main dial reads between 0 and 50 — the complete reading is 0 + 32 = 32.

*b.* The vernier dial reads 76 and the main dial reads between 650 and 700 — the complete reading is 600 + 76 = 676. (As a reminder that only the multiples of 100 on the main dial are to be added to the vernier reading, the multiples of 100 are marked by wedges.)

Three tuning charts are provided with each receiver. All are mounted in the chart frame.

# SECTION 5
# OPERATOR'S MAINTENANCE

## 1. GENERAL.

The information in this section has been prepared primarily for the use of operators, as contrasted with maintenance personnel. The purpose of these instructions is to provide the operator with a tabulated list of routine checks which will reveal any equipment abnormalities. Abnormalities should be referred to the proper maintenance authority for correction. Additionally, some notes on emergency maintenance are included.

## 2. CHECK CHART.

The tests indicated in the accompanying chart are designed to check all of the operational features of the equipment. It is recommended that these checks be made at the beginning of each watch.

**TABLE 5–1. OPERATOR'S CHECK CHART**

| WHAT TO CHECK | HOW TO CHECK | PRECAUTIONS |
|---|---|---|
| Cable plugs. | Inspect all cable plugs and make sure they are firmly secured; coupling rings on plugs should be tight. | |
| Control knobs. | Check control knobs for tightness. If loose on shaft, tighten set screws, using one of the Allen hexagon set screw keys mounted inside the receiver, at the upper right side of the chassis frame. | Do not exert too much pressure on set screw key, since it may break. Do not attempt to tighten the screw with any tool other than a hexagon key. Spare keys are contained in the spare parts box. |
| Mechanical operation. | Check mechanical operation of band switch. Turn the tuning control from one end of its range to the other. Turn GAIN and O.L. controls from 0 to 100. | When operating tuning and other rotary controls do not bang them hard against their stops at the end of rotation. |
| Power, voltmeter and lamps. | Turn on the equipment. Note whether pilot and dial lamps function, and whether normal reading (about 200 volts) is obtained on the d-c voltmeter (D.C. VOLTS). | Wait 30 seconds for tubes to warm up before reading meter. |
| Oscillator. | Place RECEPTION switch in C.W. position and tune in a signal; adjust beat note frequency to about 1,000 cycles. (AUDIO switch in BROAD position.) | |
| Output meter. | Adjust signal level successively to 0 db, +10 db, +20 db, and +30 db. | Reduce gain to zero before turning ADD DECIBELS switch from OFF position. Make gain adjustments slowly to avoid overloading meter. |
| Band-pass filter. | With ADD DECIBELS switch in 20 position, set AUDIO switch to BROAD, and adjust beat note for maximum response (1,000 cycles). | |
| Antenna compensator. | Adjust ANT. COMP. for maximum reading on the OUTPUT meter (conditions otherwise as for band-pass filter). | This adjustment should be made near the upper end of one of the frequency ranges, after which it should hold for the remainder of the range. |

**TABLE 5–1. OPERATOR'S CHECK CHART (Cont'd)**

| WHAT TO CHECK | HOW TO CHECK | PRECAUTIONS |
|---|---|---|
| Negative feedback. | With equipment operating as in above, note reading of OUTPUT meter and withdraw the headset plug from the phone jack; there should be no appreciable change in the reading of the meter. | |
| Output limiter. | With the ANT. COMP. set for maximum output, as above, turn the O.L. switch ON. Turn the OUTPUT LEVEL control to 100 and adjust the GAIN control for +25 db output level. Now adjust the OUTPUT LEVEL control successively for output levels of +20, +10, and 0 db. | After completion of test, return the ADD DECIBELS switch to OFF and the OUTPUT LEVEL control to 100. |
| Cables and leads. | With equipment operating, bend cables slightly to detect presence of poor contact or broken wire. | Avoid excessive bending as this will place undue strain on cables. |

## 3. EMERGENCY MAINTENANCE.

### Notice to Operators

Operators shall not perform any of the following emergency maintenance procedures without proper authorization.

*a.* VACUUM TUBES. — The location of receiver vacuum tubes is indicated in figure 7–10. The location of power unit tubes is indicated in the power unit supplement at the back of this book. Access to the receiver tube sockets is gained by disconnecting all cables, unscrewing the panel-retaining screws, and withdrawing the chassis as far as the stops will permit. It is not necessary to withdraw the chassis beyond this point; further withdrawal should not be attempted — the stops are employed to keep the chassis from sliding out of the cabinet when the vessel is rolling and pitching.

*b.* FUSES. — The only fuses employed, one in each side of the power line, are the two located on the front panel of the power unit. For replacement instructions see the power unit supplement at the back of this book. Fuse failure is indicated by pilot and dial lamps going out, and zero reading on the d-c voltmeter.

*c.* AUXILIARY GAIN CONTROL. — This is the potentiometer (R-128) located at the top of the tuning mechanism. In the event of failure (open circuit) its terminals may be short-circuited with a jumper; no equipment damage will result but it may be necessary to turn down the GAIN control, R-136, when operating near the high-frequency end of each band, in order to avoid over-all receiver oscillation.

# SECTION 6
# PREVENTIVE MAINTENANCE

## 1. MAINTENANCE TEST SCHEDULE.

The inspection procedures outlined in the schedule which follows are prescribed to guard against equipment failure and to detect early signs of wear or deterioration.

**Note**

THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 (OR 68) OF THE *BUREAU OF SHIPS MANUAL* OF THE LATEST ISSUE.

**TABLE 6–1. MAINTENANCE CHECK CHART**

| WHAT TO CHECK | HOW TO CHECK | PRECAUTIONS |
|---|---|---|
| | *a.* CHECK FOLLOWING MONTHLY. | |
| Performance. | Repeat all checks listed in the "Operator's Check Chart" of Section 5. While doing so, operate each switch several times to check for good contact and reliability. With no signals being received, listen closely for noise due to potentiometer wear (note that one potentiometer, R-128, is geared to the main tuning control). Observe meters for sticky pointers and pointers off zero. | |
| Cables. | Detach cables and examine for loose ferrules, damaged armor or insulation. Examine cable connectors for dirty or bent contacts, damaged coupling threads and loose parts or screws. | Clean cable connector with approved solvent on a brush or rag. Do not use sandpaper or emery cloth. |
| Set screw keys. | Check to see that the oscillator trimming tool O-103 and the two set screw keys O-101 and O-102 are in good condition and are securely mounted in their correct positions at the top of the chassis sidewall. | |
| | *b.* CHECK FOLLOWING QUARTERLY. | |
| Mounting nuts. | Examine mounting nuts and screws on panel-mounted controls (toggle switches, phone jacks, potentiometers, etc.) for tightness. | Do not use pliers to tighten mounting nuts. |
| Coil-shield retaining nuts. | Examine retaining nuts at the top of coil shields for tightness. | Do not apply undue force as this will distort the coil-mounting frame. |
| Detector cathode link. | Check link E-101 (see figure 7–10) for tightness. | |
| Vacuum tubes. | Test all vacuum tubes in a tube test set. Replace any tubes having a transconductance value less than 75 percent of normal. | |

**TABLE 6–1. MAINTENANCE CHECK CHART (Cont'd)**

| WHAT TO CHECK | HOW TO CHECK | PRECAUTIONS |
|---|---|---|
| Fuses. | Check power unit fuses for power rating (refer to power unit instructions at the back of this book). | Remove input power plug before withdrawing fuses. |
| *c.* CHECK FOLLOWING ANNUALLY. | | |
| Band switch detent spring. | If this coil spring shows signs of pulling out of place, form a stronger loop on the end with a pair of long-nose pliers, or install a spare spring. | Do not operate band switch with the detent disengaged. |
| Loose solder clips, etc. | Look the receiver over carefully for loose metal chips, solder, etc., and for solder splotches on chassis or wiring. Remove any splotches adhering to chassis or to wiring, since they may drop off in service and cause trouble. | |
| Wiring. | Examine cables of insulated wiring where they pass through partitions or around corners, looking for signs of abrasion; apply rubber tape or friction tape where signs of abrasion are evident. | |
| Set screws. | Check set screws for tightness at the following points:<br>*a.* Auxiliary gain control R-128.<br>*b.* Coupling to ANT. COMP.<br>*c.* Coupling to INPUT CPLG. switch.<br>*d.* Band switch shaft (at detent). | Do not exert undue force. |

## 2. LUBRICATION.

The principal bearings of the receiver employ bearing sleeves pressed from powdered bronze and impregnated with oil. No lubrication should be necessary for any bearing in the receiver except possibly the intermediate sleeve bearing of the main tuning capacitor; lubrication of this bearing should not be required until after a period of several years' service. To oil this bearing proceed as follows:

*a.* Remove the five screws at the top of the main tuning capacitor, C-135, and remove the shield by lifting upward. A serrated spring strip along the lower left edge of the capacitor bears on the shield with considerable force; hence it may be necessary to pry the shield off the capacitor by means of a screw driver or knife blade inserted between the shield and the capacitor frame.

*b.* The sleeve bearing is located at the front end of the middle section of the tuning capacitor. Place one drop of Navy symbol 2075 lubricant collected on the end of a wire in the coil hole provided at the top of the bearing.

*c.* Replace the shield carefully, making sure that the side of the shield rests between the spring strip and the capacitor frame. Have the shield mounting holes aligned over their respective tapped holes in the capacitor frame before pressing the shield in place. Replace the shield mounting screws and lockwashers.

# FAILURE REPORTS

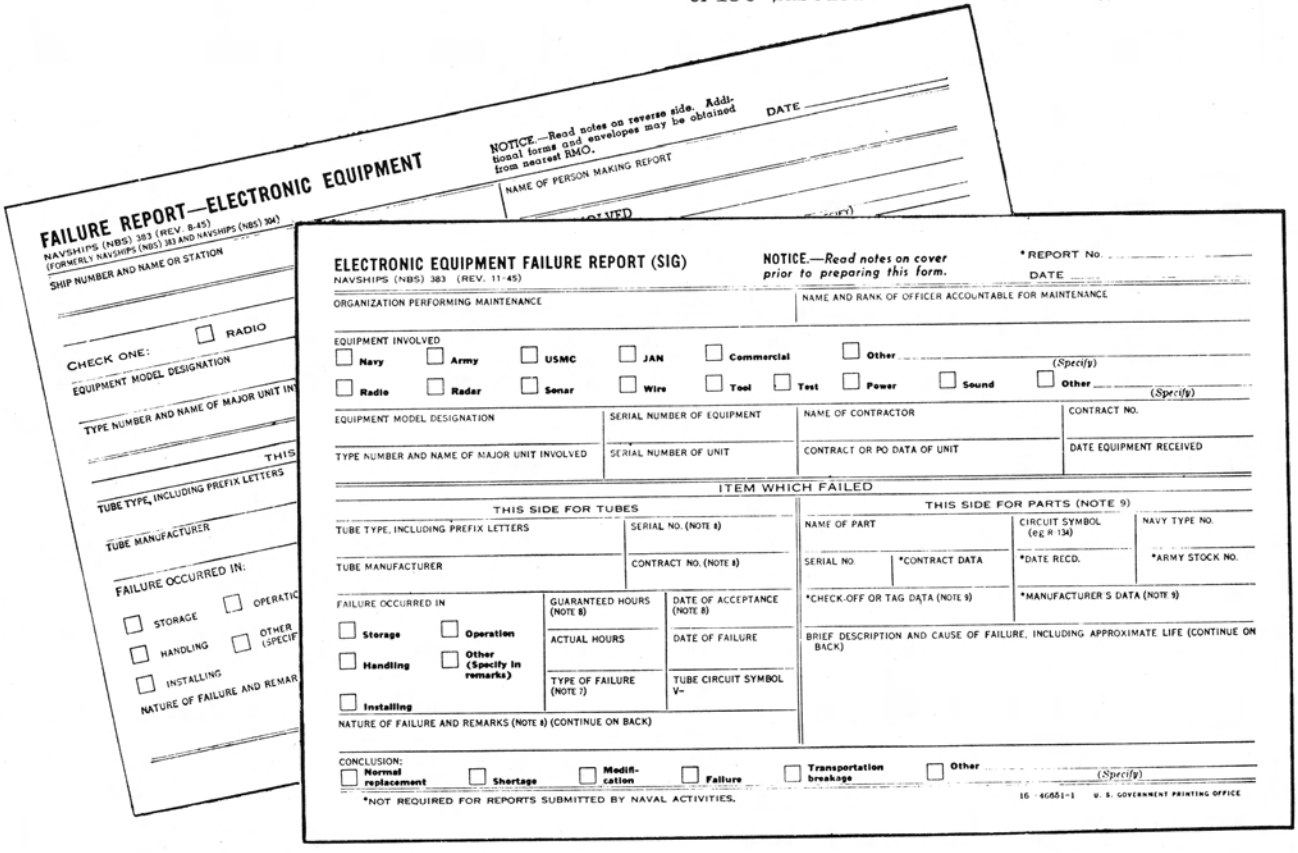
A FAILURE REPORT must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS-383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T-803, in the case of a transformer, or R-207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from the nearest district publications and printing office.



FAILURE REPORT—ELECTRONIC EQUIPMENT
NAVSHIPS (NBS) 383 (REV. 8-45)
(FORMERLY NAVSHIPS (NBS) 383 AND NAVSHIPS (NBS) 384)
SHIP NUMBER AND NAME OR STATION
CHECK ONE: RADIO
EQUIPMENT MODEL DESIGNATION
TYPE NUMBER AND NAME OF MAJOR UNIT IN
TUBE TYPE, INCLUDING PREFIX LETTERS
TUBE MANUFACTURER
FAILURE OCCURRED IN:
STORAGE
HANDLING
INSTALLING
NATURE OF FAILURE AND REMAR
NOTICE.—Read notes on reverse side. Additional forms and envelopes may be obtained from nearest BMO.
DATE
NAME OF PERSON MAKING REPORT

ELECTRONIC EQUIPMENT FAILURE REPORT (SIG)
NAVSHIPS (NBS) 383 (REV. 11-45)
NOTICE.—*Read notes on cover prior to preparing this form.*
*REPORT No.
DATE
ORGANIZATION PERFORMING MAINTENANCE
NAME AND RANK OF OFFICER ACCOUNTABLE FOR MAINTENANCE
EQUIPMENT INVOLVED
Navy Army USMC JAN Commercial Other (Specify)
Radio Radar Sonar Wire Tool Test Power Sound Other (Specify)
EQUIPMENT MODEL DESIGNATION
SERIAL NUMBER OF EQUIPMENT
NAME OF CONTRACTOR
CONTRACT NO.
TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED
SERIAL NUMBER OF UNIT
CONTRACT OR PO DATA OF UNIT
DATE EQUIPMENT RECEIVED
ITEM WHICH FAILED
THIS SIDE FOR TUBES
TUBE TYPE, INCLUDING PREFIX LETTERS
SERIAL NO. (NOTE 8)
TUBE MANUFACTURER
CONTRACT NO. (NOTE 8)
FAILURE OCCURRED IN
Storage Operation Handling Other (Specify in remarks) Installing
GUARANTEED HOURS (NOTE 8)
DATE OF ACCEPTANCE (NOTE 8)
ACTUAL HOURS
DATE OF FAILURE
TYPE OF FAILURE (NOTE 7)
TUBE CIRCUIT SYMBOL V-
NATURE OF FAILURE AND REMARKS (NOTE 8) (CONTINUE ON BACK)
THIS SIDE FOR PARTS (NOTE 9)
NAME OF PART
CIRCUIT SYMBOL (eg R 134)
NAVY TYPE NO.
SERIAL NO.
*CONTRACT DATA
*DATE RECD.
*ARMY STOCK NO.
*CHECK-OFF OR TAG DATA (NOTE 9)
*MANUFACTURER'S DATA (NOTE 9)
BRIEF DESCRIPTION AND CAUSE OF FAILURE, INCLUDING APPROXIMATE LIFE (CONTINUE ON BACK)
CONCLUSION:
Normal replacement Shortage Modification Failure Transportation breakage Other (Specify)
*NOT REQUIRED FOR REPORTS SUBMITTED BY NAVAL ACTIVITIES.
16 - 46651-1 U. S. GOVERNMENT PRINTING OFFICE

*Figure 7—1. Failure Report*

# SECTION 7
# CORRECTIVE MAINTENANCE

## 1. LOCATION AND REMEDY OF FAULTS.

*(See figures 7–16 and 7–17.)*

*a.* GENERAL. — The general techniques of trouble shooting and repair of any electronic equipment are applicable to the RBA-7 equipment. Trouble shooting should proceed in a logical manner, based on observation of the nature of the fault. Troubles in the power supply or high-voltage circuits would generally be indicated by an abnormal reading of the d-c voltmeter M-102. Trouble of this nature is located readily and specifically by detailed voltage and resistance analysis. Lack of signal despite normal voltage supply should be isolated by circuit disturbance tests to determine the point along the signal path from antenna to headphone where the signal fails. Voltage measurements along this path normally produce clicking sounds in the headphones due to the small arcs set up as the test probe is moved from point-to-point. The trouble shooter will recognize the normal reactions of this type of test after very little experience. Trouble in any of the coils of a particular band as well as any troublesome switch contacts associated with a particular band may usually be detected by observing comparative receiver behaviour on all bands. Once the trouble is isolated to a particular stage of a receiver it may be further isolated to a specific component by voltage, resistance and current measurement techniques. These techniques fail to reveal such defects as open capacitors or shorted turns in a coil; therefore this type of trouble, when suspected, should be isolated and eliminated by substitution of the suspected component. More difficult faults are those of an intermittent nature, those caused by more than one defective component, or those caused by general over-all component deterioration. In these cases persistency in observing and tracing the defect will eventually track down the offending components.

Careful observation will usually prove helpful in the initial isolation of the trouble. The amount of receiver noise heard in the headset in the absence of a signal will indicate the amount of amplification between an inoperative stage and the headset. Weak signals might indicate faulty coupling, either between two receiver stages or in the antenna input system. Hum or oscillations would indicate faulty bypass or filter capacitors.

Some of the troubles encountered in receiver installations of this type are tabulated below, together with some common causes.

For identification of the various components in the receiver refer to figures 7–2, 7–3, 7–4, and 7–5. Corrective maintenance procedure for the power supply is given in Appendix 1 at the rear of this book.

*b.* VOLTAGE ANALYSIS. — The voltage measurements shown in figure 7–5, for the stated conditions, are indicative of normal receiver behaviour. To aid in quickly determining the source of each voltage the connections for all tubes are shown in figure 7–6. A routine check of receiver performance should include the operation of each gain control in at least the two extreme positions of each. The following tabulations are included to facilitate such tests.

(1) MANUAL GAIN CONTROL TEST. — This test is made with the main tuning control at 0 and the manual GAIN control set as stated.

| TUBE | GAIN SETTING | VOLTAGE TO CHASSIS | | | | | |
|---|---|---|---|---|---|---|---|
| | | PIN #1 | PIN #3 | PIN #4 | PIN #5 | PIN #6 | PIN #8 |
| V-102, 1st R-F Amp. | 0 | 0 | 43 | 0 | 43 | 126 | 206 |
| | 100 | 0 | 6.6 | 0 | 6.6 | 103 | 194 |
| V-103, 2nd R-F Amp. | 0 | 0 | 43 | 0 | 43 | 126 | 206 |
| | 100 | 0 | 6.6 | 0 | 6.6 | 103 | 194 |

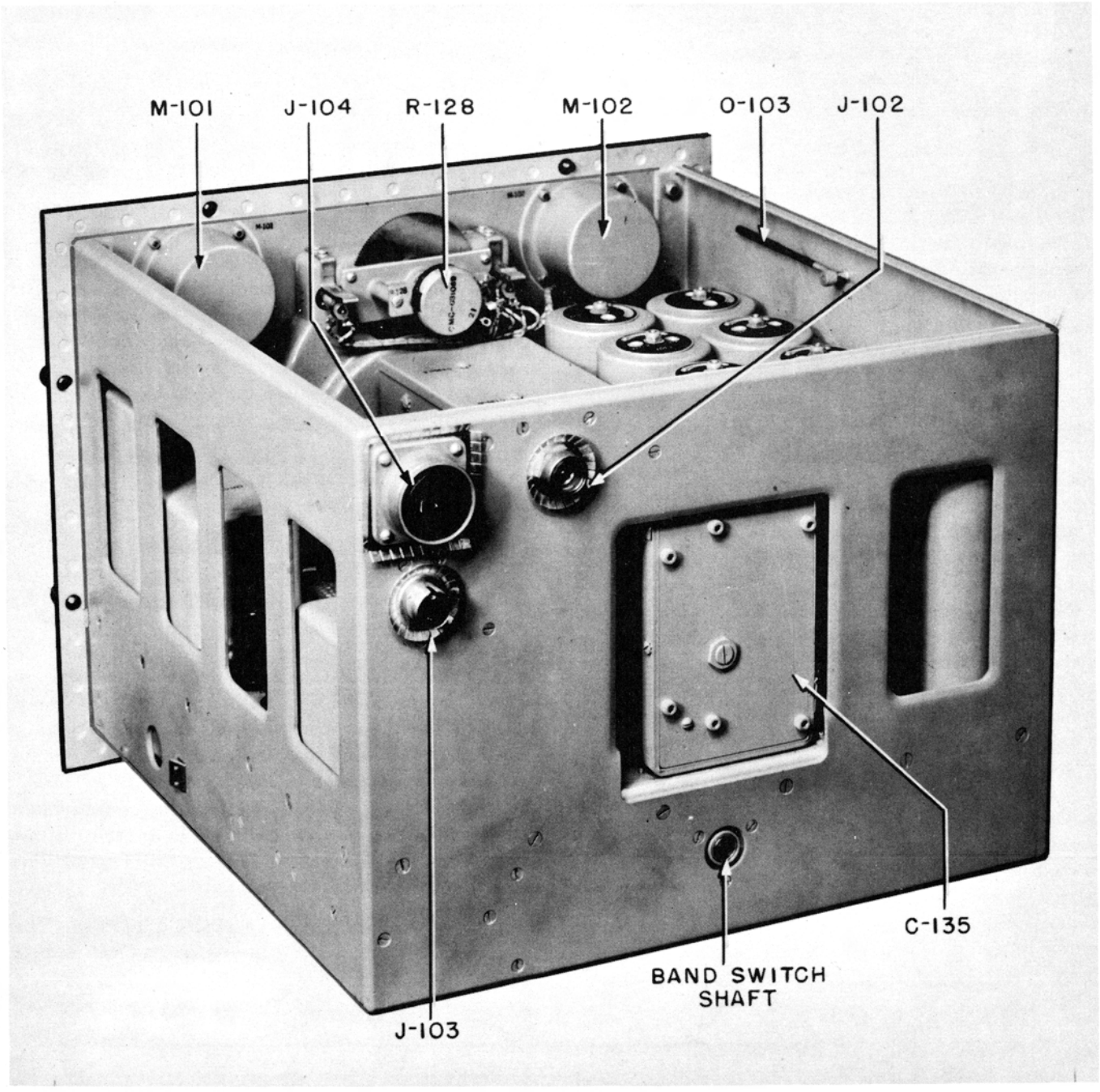



*Figure 7—2. Receiver Chassis, Rear Oblique View*

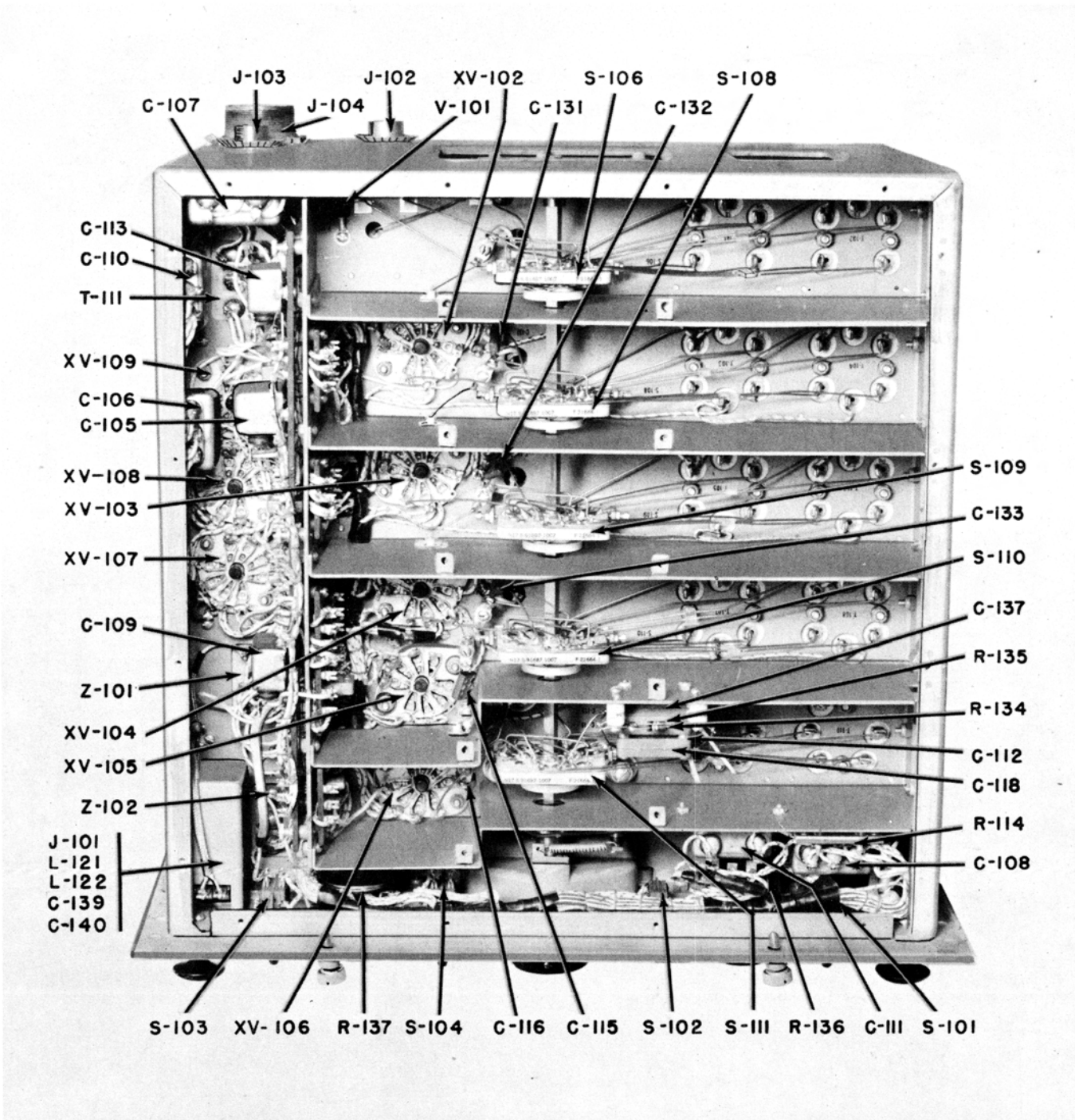



*Figure 7—3. Receiver Chassis, Bottom View*

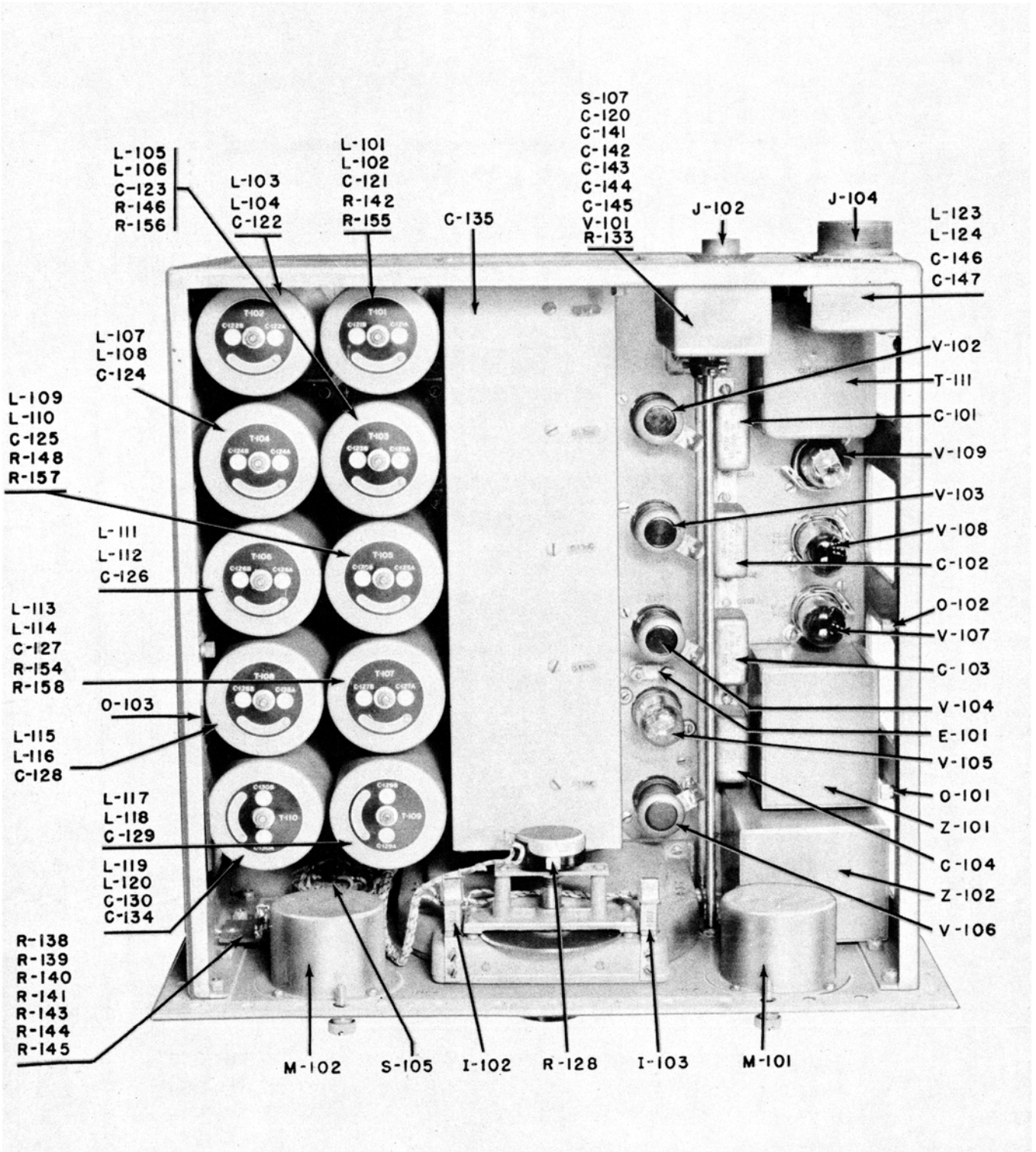



*Figure 7—4. Receiver Chassis, Top View, Showing Tube Locations*

## TABLE 7–1. TROUBLE SHOOTING CHART

| TROUBLE INDICATION | PROBABLE SOURCE | PROBABLE CAUSE | REMEDY |
|---|---|---|---|
| No signal or weak signal. | Failure of power supply. | Blown fuse. | Replace. |
| | | Burned out or weak rectifier tube. | Replace. |
| | | Faulty contact to rectifier pins. | Clean. |
| | | Faulty receiver ON-OFF switch. | Replace. |
| | | Break in continuity of power unit input or output cable (probably at cable plug). | Seat plugs firmly in their mating receptacles. |
| | Faulty antenna connection. | Poor contact between input receptacle and the mating plug or adapter. | Correct. |
| | | Ground or open circuit in the antenna lead-in, transmission line, or patch cord. | Correct. |
| | Faulty output connection. | Open-circuited, short-circuited, or grounded output cable (neither side of the output line should be grounded). | Correct. |
| | | Defective headset cord or plug. | Replace. |
| | | Poor contact between output receptacle and plug. | Clean. |
| | Weak or burned-out vacuum tube. | | Check tube with suitable test set. If this is not available, replace each tube, in turn, with a tube known to be in good condition.<br>If possible, check socket voltages with good tubes in place; unusual voltages are an indication that the particular stage involved is at fault. |
| | Wrong vacuum tube inserted in socket. | | |
| | Incorrect position of INPUT CPLG. switch and ANT. COMP. control. | | Tune input circuit to resonance. |
| | Output Limiter adjusted for low output level. | | Readjust. |
| | Beat note frequency outside of pass band of filters. | Oscillator operating on wrong frequency. | Correct. |

## TABLE 7–1. TROUBLE SHOOTING CHART (Cont'd)

| TROUBLE INDICATION | PROBABLE SOURCE | PROBABLE CAUSE | REMEDY |
|---|---|---|---|
| No signal or weak signal. | Defective manual gain control or auxiliary gain control. | | Replace control. |
| | Defective wave filter. | | Try the other filter. |
| | Defective toggle switch. | | Replace. |
| | Defective section of wave band switch. | | Replace section. |
| | Broken wire lead. This is more likely to occur to leads connected to the long bakelite resistor-capacitor strip in the audio-frequency compartment. | | Correct. |
| | Shorted bypass capacitor. | | Replace. |
| | Detector cathode link E-101 open. | | |
| | Shorted trimmer capacitor. | Drop of solder.<br>Bent plates. | Clean.<br>Correct. |
| Noisy or intermittent reception. | Faulty contact or noise pick up in antenna system. | | Disconnect antenna and observe whether noise stops. |
| | Faulty cable connection. | Connectors loosely mated. Breakage of a cable conductor, usually where soldered to a receptacle or plug contact, or at a point where frequent cable bending occurs. | Locate and correct. |
| | Defective headset cord, or plug, or faulty connection between plug, cord and headset. | | Correct or replace. |
| | Defective gain or output level control. | | Replace. |
| | Worn-out auxiliary gain control, R-128. | | Replace. |
| | Defective toggle switch. | | Replace. |
| | Poor contact between some vacuum tube and its socket. | | Locate and correct. |
| | Defective vacuum tube. | | Tap each tube lightly to locate. Replace. |

## TABLE 7–1. TROUBLE SHOOTING CHART (Cont'd)

| TROUBLE INDICATION | PROBABLE SOURCE | PROBABLE CAUSE | REMEDY |
|---|---|---|---|
| Noisy or intermittent reception. | Frayed or broken connection in receiver wiring. | | Check by shaking receiver. Correct. |
| | Poor contact between pilot or dial lamp and its socket. | | Correct. |
| | Defective wave filter. | | Try the other filter. |
| | Defective bypass or coupling capacitor. | | Replace. |
| | Defective power unit. (Observe whether noise is accompanied by fluctuations in reading of d-c voltmeter; marked fluctuations would indicate that the trouble is probably in the receiver's power unit or power cable rather than in the antenna or output system.) | | |
| | Reception accompanied by a continuous high value of receiver background noise (rush) may be due to some external factor causing weak signals, since weak signal input voltage naturally results in a poor signal/noise ratio. | | |
| | Retaining nut on top of coil shield not tightened. | | Tighten. |
| | Detector cathode link E-101 loosely secured. | | Tighten. |
| | Flaked plating on trimmer or main tuning capacitor. | | Replace capacitor. |
| | Dirty or corroded bandswitch contact. | | Clean. |
| | Vacuum tube with "intermittent heater". | Heater element periodically makes and breaks contact due to expansion and contraction of the ceramic material in which the heater is embedded. | Tube tester does not usually indicate this type of defect, unless the tubes were left in test set long enough to become thoroughly warm. Check each tube in turn with tube known to be operating. |

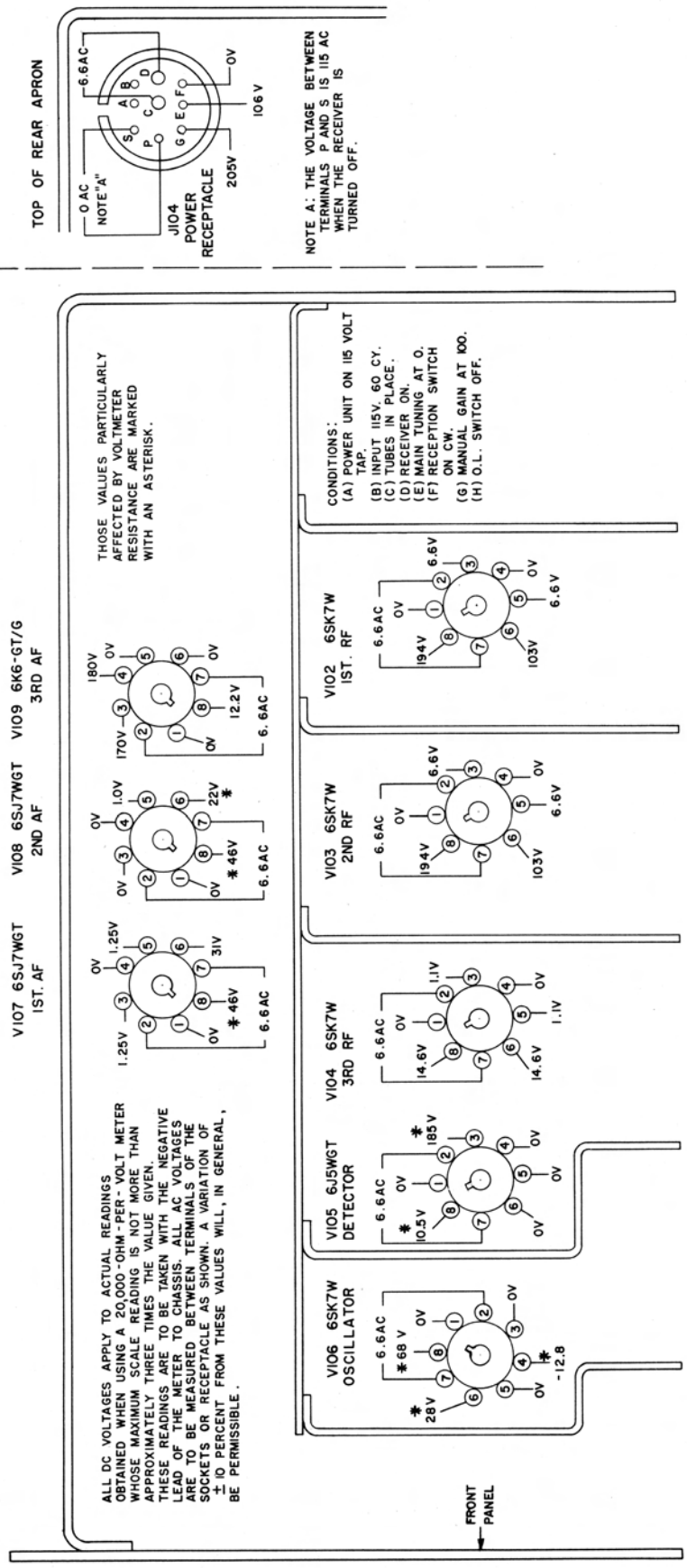



*Figure 7–5. Voltage Analysis Chart*

**Note**

The following conditions of measurement apply in table 7–2 below:

CONDITIONS OF MEASUREMENT:
(a) Power unit tap set corresponding to line voltage.
(b) All tubes in place.
(c) Receiver on.
(d) Main tuning control at 0.
(e) RECEPTION switch on C.W.
(f) Manual GAIN control at 100.
(g) O.L. switch OFF.
(h) All measurements made with 20,000 ohms/volt meter.

## TABLE 7–2. TUBE OPERATING VOLTAGES AND CURRENTS

| TUBE TYPE | FUNCTION | PLATE | | SCREEN | | GRID | CATHODE | HEATER |
|---|---|---|---|---|---|---|---|---|
| | | (E) | (MA) | (E) | (MA) | (E) | (E) | (E) A. C. |
| 6SK7 W | 1st RF | 194 | 4.5 | 103 | 1.0 | 0 | 6.6 | 6.6 |
| 6SK7 W | 2nd RF | 194 | 4.5 | 103 | 1.0 | 0 | 6.6 | 6.6 |
| 6SK7 W | 3rd RF | 14.6 | 0.4 | 14.6 | 0.1 | 0 | 1.1 | 6.6 |
| 6SK7 W | Oscillator | 68 | 0.37 | 28 | 0.35 | –14.8 | 0.0 | 6.6 |
| 6J5 WGT | Detector | *185 | 0.16 | — | — | 0 | *10.5 | 6.6 |
| 6SJ7 WGT | 1st AF | *46 | 0.6 | 31 | 0.06 | 0 | 1.25 | 6.6 |
| 6SJ7 WGT | 2nd AF | *46 | 0.6 | *22 | 0.16 | 0 | 1.0 | 6.6 |
| 6K6 GT/G | 3rd AF | 170 | 23 | 180 | 4.0 | 0 | 12.2 | 6.6 |

*Affected by voltmeter resistance.

## TABLE 7–3. TUBE CHARACTERISTICS

| TUBE TYPE | FILAMENT | | PLATE | | GRID BIAS (V) | SCREEN | | A-C PLATE RESISTANCE (OHMS) | VOLTAGE AMPLIFICATION FACTOR (MU) | TRANSCONDUCTANCE (MICROMHOS) | | EMISSION | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VOLTAGE (V) | CURRENT (MA) | VOLTAGE (V) | CURRENT (MA) | | VOLTAGE (V) | CURRENT (MA) | | | NORMAL | MINIMUM | $I_s$ MA | TEST VOLT DC |
| 6SK7 W | 6.3 | 300 | 250 | 9.2 | –3 | 100 | 2.6 | 800,000 | — | 2000 | 1600 | 65 | 30 |
| 6J5 WGT | 6.3 | 300 | 250 | 9 | –8 | — | — | 7700 | 20 | 2600 | 2075 | 40 | 30 |
| 6SJ7 WGT | 6.3 | 300 | 250 | 3 | –3 | 100 | 0.8 | 1,500,000 | — | 1650 | 1325 | 60 | 30 |
| 6K6 GT/G | 6.3 | 400 | 250 | 32 | –18 | 250 | 5.5 | 90,000 | — | 2300 | 1800 | 40 | 30 |

**Note**

ALL TUBES OF A GIVEN TYPE SUPPLIED WITH THE EQUIPMENT SHALL BE CONSUMED PRIOR TO EMPOYMENT OF TUBES FROM GENERAL STOCK.

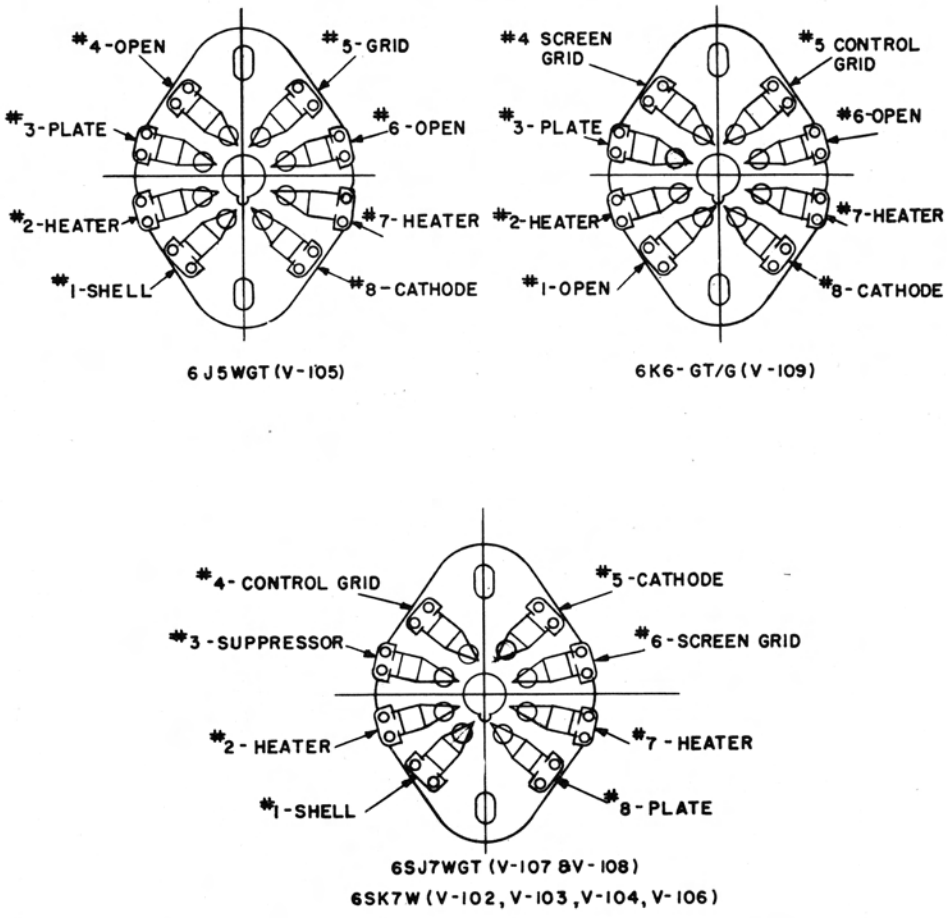



*Figure 7–6. Tube Socket Diagrams, Bottom View*

(2) AUXILIARY GAIN CONTROL TEST. — This test is made with the manual GAIN control at 100 and the main tuning control set as stated.

| TUBE | DIAL SETTING | VOLTAGE TO CHASSIS | | | | | |
|---|---|---|---|---|---|---|---|
| | | PIN #1 | PIN #3 | PIN #4 | PIN #5 | PIN #6 | PIN #8 |
| V-102, 1st R-F Amp. | 0 | 0 | 6.6 | 0 | 6.6 | 103 | 194 |
| | 1000 | 0 | 20 | 0 | 20 | 129 | 204 |
| V-103, 2nd R-F Amp. | 0 | 0 | 6.6 | 0 | 6.6 | 103 | 194 |
| | 1000 | 0 | 20 | 0 | 20 | 129 | 204 |

(3) OUTPUT LEVEL CONTROL TEST. — This test is made with the main tuning control at 1,000, the manual GAIN control at 100, the O.L. switch turned ON and the OUTPUT LEVEL control set as shown.

| OUTPUT LEVEL CONTROL | VOLTAGE TO CHASSIS V-108 PIN #8 2ND A-F AMP |
|---|---|
| 0 | 0 |
| 50 | 5.8* |
| 100 | 18* |

*Affected by voltmeter resistance.

*c.* RESISTANCE ANALYSIS. — The resistance measurements shown in figure 7–7 for the stated conditions are indicative of normal receiver behaviour. The socket connections shown in figure 7–6 will aid in determining the type of connection associated with each pin. To locate the component causing any discrepancy between the indicated and the measured resistance, refer to the main schematic diagram, figure 7–16.

If a resistance measurement of a variable element, such as any of the gain controls, is considered necessary

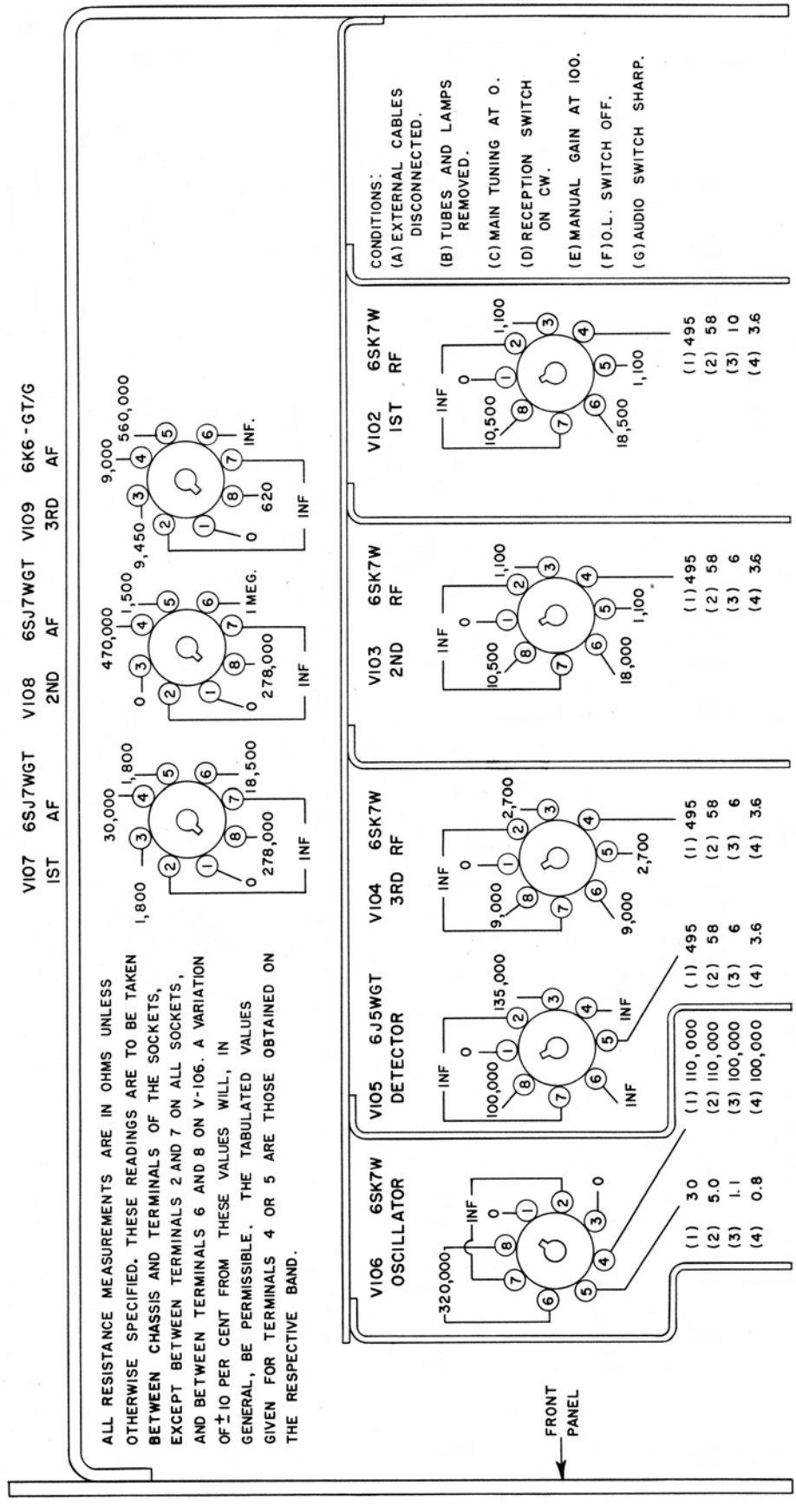



*Figure 7–7. Resistance Analysis Chart*

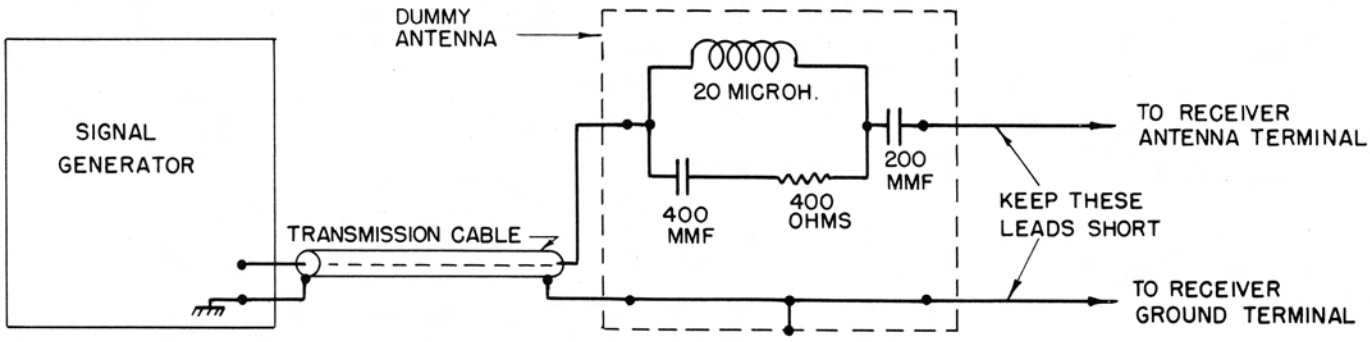



*Figure 7–8. Dummy Antenna Connections*

it may best be performed by applying the ohmmeter test probes to the center contact and one end contact of the control and rotating the control slowly through its range. Watch for open contact during rotation and compare maximum measured resistance with the nominal value for the control.

*d.* PERFORMANCE TEST. — An over-all test of receiver performance will quickly indicate the presence of any unsuspected trouble. Such a test includes a systematic listening procedure, as outlined under *a* in table 6–1, sensitivity tests, and a selectivity test.

The following test equipment is required to make the sensitivity tests and/or the selectivity test:

NAVY TYPE -66017 DUMMY ANTENNA. This is an LCR network, shown in figure 7–8, which is used to simulate the characteristics of a typical antenna. If such a device is not available a 200-mmf series capacitor may be used with essentially the same results. At this writing (1951) the Navy type -66017 dummy antenna is the same as the Institute of Radio Engineers dummy antenna.

DUMMY TRANSMISSION LINE. This is a capacitive network, shown in figure 7–9, which may be used alternatively to simulate the characteristics of a transmission line.

SIGNAL GENERATOR. A signal generator, such as the LP type, with a calibrated output covering the frequency range of the RBA-7 receiver.

TEST METER. Either a 0- to 500-microampere meter, such as the Navy type -60107, or a 0- to 50-volt vacuum tube voltmeter, such as the Navy Model OBQ series.

AUDIO OSCILLATOR. An audio oscillator capable of delivering a known 6-milliwatt, 1,000-cps signal at 600 ohms.

DECADE ATTENUATOR. A 600-ohm decade attenuation network capable of producing at least 60 db of calibrated attenuation.

(1) OVERALL SENSITIVITY TEST. — This test may be performed with either the DUMMY ANTENNA or the DUMMY TRANSMISSION LINE. Proceed as follows:

(*a*) Connect the signal generator to the receiver input receptacle through either the dummy antenna or transmission line. Refer to figure 7–8 or figure 7–9.

(*b*) With the receiver turned on set the INPUT CPLG. switch to 3 if the dummy transmission line is being used or 5 if the dummy antenna is being used, the RECEPTION switch to C.W., the O.L. switch to OFF, and the AUDIO switch to BROAD.

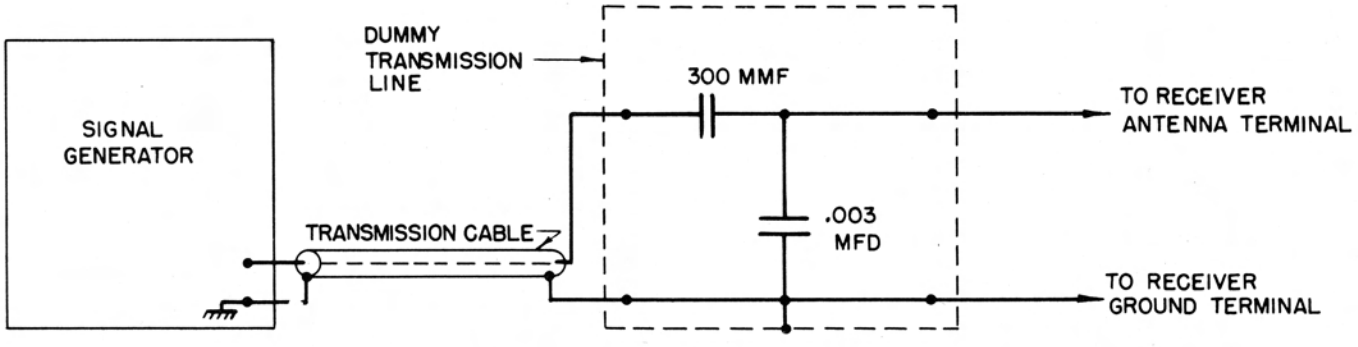



*Figure 7–9. Dummy Transmission Line Connections*

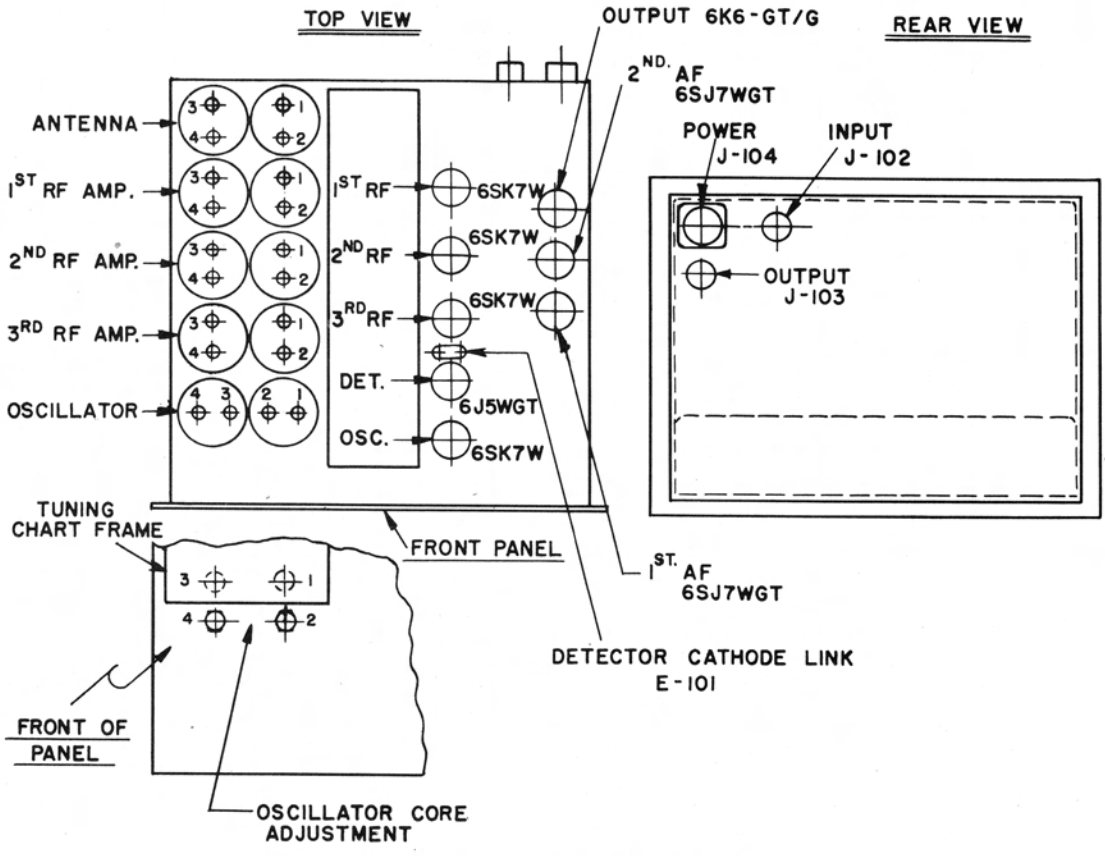



*Figure 7–10. Chassis Layout Diagram*

(*c*) Connect a 600-ohm output meter to the output of the receiver and shunt a high impedance headset across the meter for monitoring purposes; alternatively, connect a 600-ohm resistor, shunted by a high impedance headset, to the receiver output and use the receiver output meter. A 600-ohm headset may be used in lieu of the 600-ohm resistor but the results will not be quite as accurate.

(*d*) Adjust the signal generator to 600 kc and set the attenuator on the generator for about 10 microvolts output. Tune in the signal and adjust for a 1,000-cps beat note. (If beat notes are audible on either side of the carrier, adjust for the louder beat.) Set the ANT. COMP. for maximum output.

(*e*) Cut off the signal generator. Adjust the receiver gain control so that 60 microwatts of receiver noise is measured in the output circuit with the ADD DECIBELS switch on DIRECT (zero decibels on the receiver panel meter).

(*f*) Set the signal generator output dial to zero. Decrease the output meter sensitivity by 20 decibels from that previously used. (Advance the ADD DECIBELS switch by 20 if the receiver panel meter is being used.) Adjust the signal generator output for a reading of 6 milliwatts (zero db). The signal generator output microvoltage at this point indicates the receiver sensitivity and should be approximately equal to the sensitivity values listed in figure 7–11 for the dummy antenna or the values listed in table 7–4 for the dummy transmission line.

(*g*) Repeat the above procedure [steps (*d*), (*e*), and (*f*)] for the center and ends of each band, adjusting the ANT. COMP. only at the high frequency end of each band.

**TABLE 7–4. TYPICAL C-W SENSITIVITY (DUMMY TRANSMISSION LINE)**

| BAND NO. | FREQUENCY KC | SENSITIVITY MICROVOLTS |
|---|---|---|
| 1 | 15 | 60 |
| 1 | 38 | 10 |
| 2 | 38 | 20 |
| 2 | 95 | 5 |
| 3 | 95 | 12 |
| 3 | 235 | 5 |
| 4 | 235 | 9 |
| 4 | 600 | 5 |

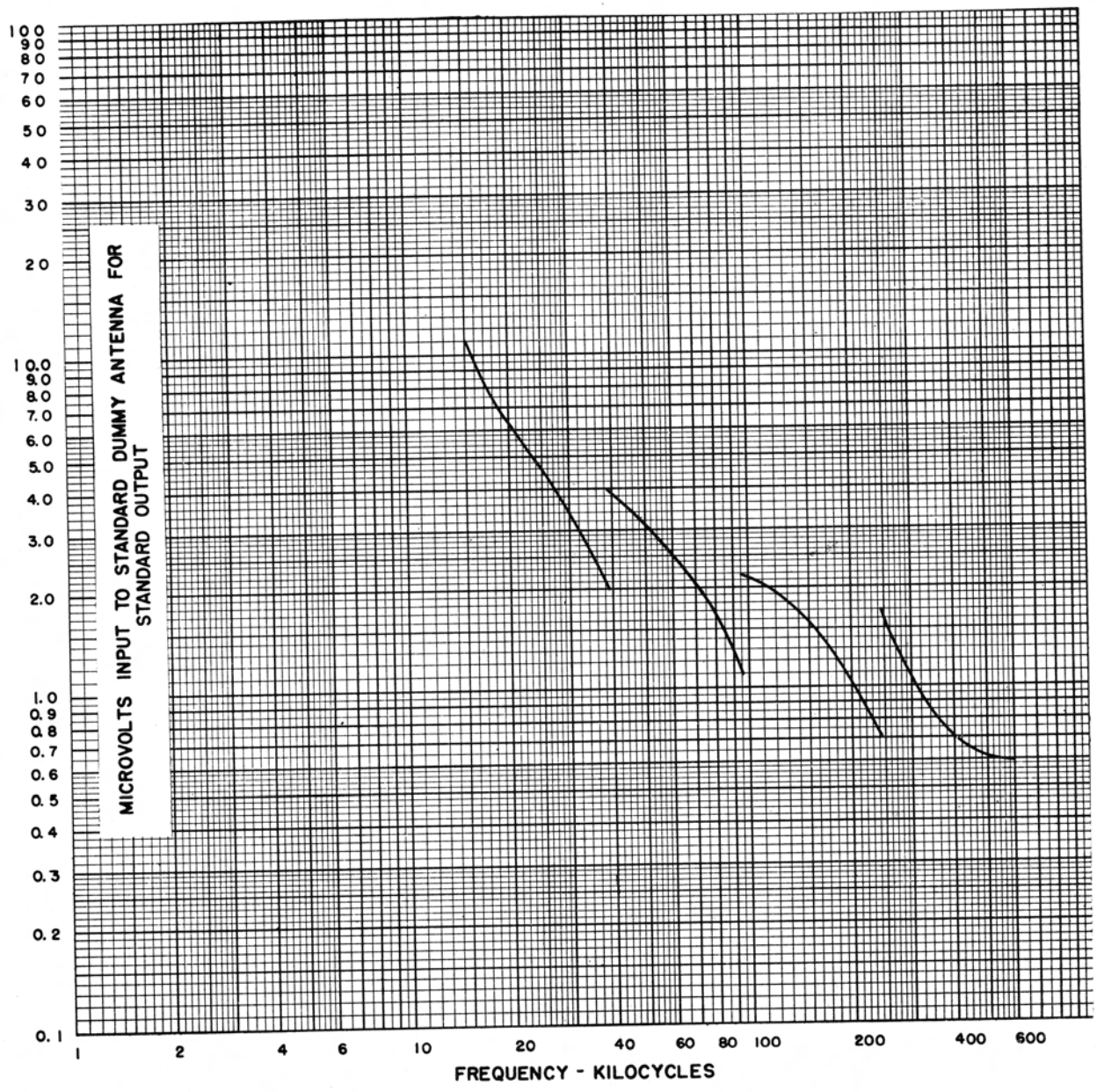



*Figure 7—11. Typical C-W Sensitivity (Dummy Antenna)*

(*b*) If the over-all sensitivity of the receiver appears to be subnormal, the exact cause of the loss of gain may be isolated by measurement of the stage-by-stage gain of the receiver and by a check on the receiver selectivity. The test procedures for checking R-F gain, A-F gain, and receiver selectivity are given below.

(2) R-F SENSITIVITY TEST. — This test involves progressive gain measurement of the various R-F stages, including the tuned antenna circuits, by injecting a test signal at various receiver test points. Proceed as follows:

(*a*) Set up the signal generator and the dummy antenna so that a probe may be moved from point-to-point in the receiver to inject signal from the dummy antenna into the R-F circuits.

(*b*) With the receiver set up so that the chassis underside is exposed, turn on the receiver power.

**CAUTION**

HIGH VOLTAGES, UP TO 250 VOLTS DC, APPEAR AT EXPOSED TERMINALS ON THE UNDERSIDE OF THE RECEIVER.

(*c*) Arrange the signal generator so that a 400-cps, 30-percent modulated signal may be injected into

the various receiver stages through the dummy antenna. Initially inject the signal into the antenna receptacle. Use about 10 microvolts.

(*d*) Set the receiver INPUT CPLG. switch to 5, the RECEPTION switch to MOD., the O.L. switch to OFF, the AUDIO switch to BROAD, the ADD DECIBELS switch to 20, and the GAIN control to 100.

(*e*) Tune the signal generator and the receiver to 600 kc. Peak the ANT. COMP. for maximum output. Adjust the signal generator output so that the receiver output meter reads 0 db.

(*f*) Note carefully the signal generator output voltage. Remove the signal connection to the antenna receptacle and apply it to pin 4 of V102, the 1st R-F stage. Increase the signal generator output voltage until the receiver output meter again reads 0 db. The ratio of the two output voltages is the gain between the two points just measured. This should be compared with the data in table 7–5, if the dummy transmission line is being used, or figure 7–11 if the dummy antenna is being used.

$$\frac{E_2 \text{ (1st RF)}}{E_1 \text{ (Ant.)}} = \text{STAGE GAIN (Ant.)}$$

(*g*) Move the test probe from point to point (pin 4 of each R-F stage) as indicated in table 7–5; the measuring point indicating 3rd R-F output level is the detector grid (pin 5, V-105). The ratio of input voltage to output voltage of each stage, for 0-db reference output, is the gain for that stage.

(*h*) Repeat the above procedure, steps (*e*) and (*g*), for each of the frequencies listed in table 7–5.

**TABLE 7–5. R-F STAGE GAIN**

| BAND | FREQ. K.C. | ANTENNA | STAGE GAIN | | |
|---|---|---|---|---|---|
| | | | 1ST R-F | 2ND R-F | 3RD R-F |
| 1 | 15 | 1.1 | 18.0 | 14.6 | 5.7 |
| 1 | 38 | 14.6 | 5.8 | 7.3 | 32.0 |
| 2 | 38 | 2.6 | 19.7 | 17.6 | 7.9 |
| 2 | 95 | 33 | 5.4 | 7.1 | 32.6 |
| 3 | 95 | 5.3 | 18.2 | 17.9 | 6.9 |
| 3 | 235 | 41 | 2.9 | 3.2 | 18.7 |
| 4 | 235 | 6.3 | 21.5 | 20.6 | 10.6 |
| 4 | 600 | 42 | 3.9 | 4.3 | 26.6 |

(3) A-F SENSITIVITY TEST. — This test, like the R-F sensitivity test, involves a progressive stage-by-stage measurement of receiver gain in order to determine the individual gains of each stage. Unlike the R-F sensitivity test, reliance is placed on both known input and known final output voltages. The gain measurement is in terms of voltage (not power) gain from the point of signal injection to the output terminals of the receiver. Included between these points is the voltage loss, due to transformer step-down ratio, of the output transformer. Proceed as follows:

(*a*) Set up the audio oscillator and the decade attenuator so that 1,000 cps at 0 db in 600 ohms (6 milliwatts) will be delivered from the attenuator with the attenuator set for zero attenuation. Adjust the attenuator for 60-db attenuation.

(*b*) Insert a small insulating strip of paper between the arm and contacts of switch section S-110C. Connect a probe from the attenuator output to the detector grid (pin 5, V-105).

(*c*) Turn the receiver on. Set the GAIN control at 100, the AUDIO switch on BROAD, the O.L. at OFF, and the ADD DECIBELS switch at 20.

**CAUTION**

HIGH VOLTAGES, UP TO 250 VOLTS DC, APPEAR AT EXPOSED TERMINALS ON THE UNDERSIDE OF THE RECEIVER.

(*d*) Adjust the decade attenuator so that the receiver output meter reads 0 db. (The receiver should have a 600-ohm load, either the headset or a resistor.) The setting of the decade attenuator, at this point, is the total voltage gain between the detector grid and the output load winding. This should be compared with the data listed, for the detector, in table 7–6.

(*e*) Move the test signal probe from point-to-point, as indicated in table 7–6, resetting the attenuator at each point, to determine the total gain from that point to the output load winding. A weak stage, once isolated, should be carefully checked by the trouble-shooting procedures previously described.

**TABLE 7–6. A-F STAGE GAIN**

| INPUT TO GRID OF | GAIN BETWEEN POINT OF INPUT AND 600-OHM LOAD |
|---|---|
| 3rd A-F Amp (Pin 5, V-109) | 9 db |
| 2nd A-F Amp (Pin 4, V-108) | 9*db |
| 1st A-F Amp (Pin 4, V-107) | 49 db |
| Detector (Pin 5, V-105) | 51 db |

*Gain of 2nd A-F stage neutralized by negative feedback.

(4) SELECTIVITY TEST. — This test is made with a pure C-W input by measuring the detector cathode voltage or current as the test generator is tuned to various points on either side of center frequency. With the highly selective tuned circuits used in this receiver, such a procedure is simpler and more accurate than the conventional procedure which measures the sideband pattern of a modulated signal. Either the voltage or current in the cathode circuit of the detector may be measured depending on the test equipment available. Proceed as follows:

(*a*) Connect the 0- to 500-microampere meter in series with the detector cathode by loosening the nuts which hold link E-101 in place, removing the link, and connecting the microammeter probes in its place. Observe polarity, connecting the negative lead to the grounded terminal. Note the location of E-101 as shown in figure 7–10; it is located on the top side of the chassis adjacent to V-105, the 6J5 detector tube.

Alternatively, connect the VTVM across the detector load resistor, R-110. Adjust the VTVM to the 0- to 50-volt scale.

(*b*) Connect the signal generator, through the DUMMY ANTENNA, to the receiver input terminals as shown in figure 7–8.

(*c*) Set the INPUT CPLG. switch at 5 and the RECEPTION switch to MOD. Set the signal generator at the desired frequency and the signal generator output control at 100 microvolts. Carefully tune the receiver main tuning control and ANT. COMP. for peak meter deflection. Adjust the gain control so that the meter reads 140 microamperes or (with the VTVM) 14 volts.

(*d*) Detune the signal generator toward a higher frequency so that the meter reading remains unchanged with the signal generator output increased by a factor of 10:1. Read the signal generator frequency accurately and record it as $F_2$. Repeat on the low side of resonance and record this frequency as $F_1$.

$$\frac{F_2 - F_1}{2} = \text{KC off resonance.}$$

$$\frac{\text{KC off resonance} \times 100}{\text{Resonant frequency}} = \text{percentage off resonance}$$

(*e*) Repeat this procedure [(*c*) and (*d*)] for 100 : 1 and 1,000 : 1 voltage ratios. Compare the results obtained at the specified frequencies for each band with the selectivity curves shown in figure 7–12. If selectivity is non-symmetrical, or is too broad, an alignment procedure on each malfunctioning band is required. If the selectivity on bands 1 or 2 is too sharp, a shorted series resistor in the secondary circuit of one or more coils is indicated.

## 2. REPAIR TECHNIQUES.

Once the malfunctioning component is isolated by the preceding trouble-shooting techniques the required corrective measure is usually obvious. Treated below are some of the less obvious techniques which may be required in the repair on an RBA-7 receiver.

*a.* ALIGNMENT. — Realignment of the RBA-7 receiver may be required periodically. All tuned circuit adjustments may be expected to drift with time. Realignment may also be required if a tube or some other component is changed. In general the complete realignment may not be required at any given time. The accuracy of receiver alignment is readily indicated by the selectivity and sensitivity measurements previously described.

**Note**

A realignment procedure should not be attempted unless tests have definitely established that it is required.

Using the test equipment required for the selectivity test, as outlined in Section 7, paragraph 1 *d*, proceed as follows:

(1) Connect the signal generator to the receiver as shown in figure 7–8.

(2) Connect the test meter into the detector cathode circuit as described in Section 7, paragraph 1 *d* (2) (*a*).

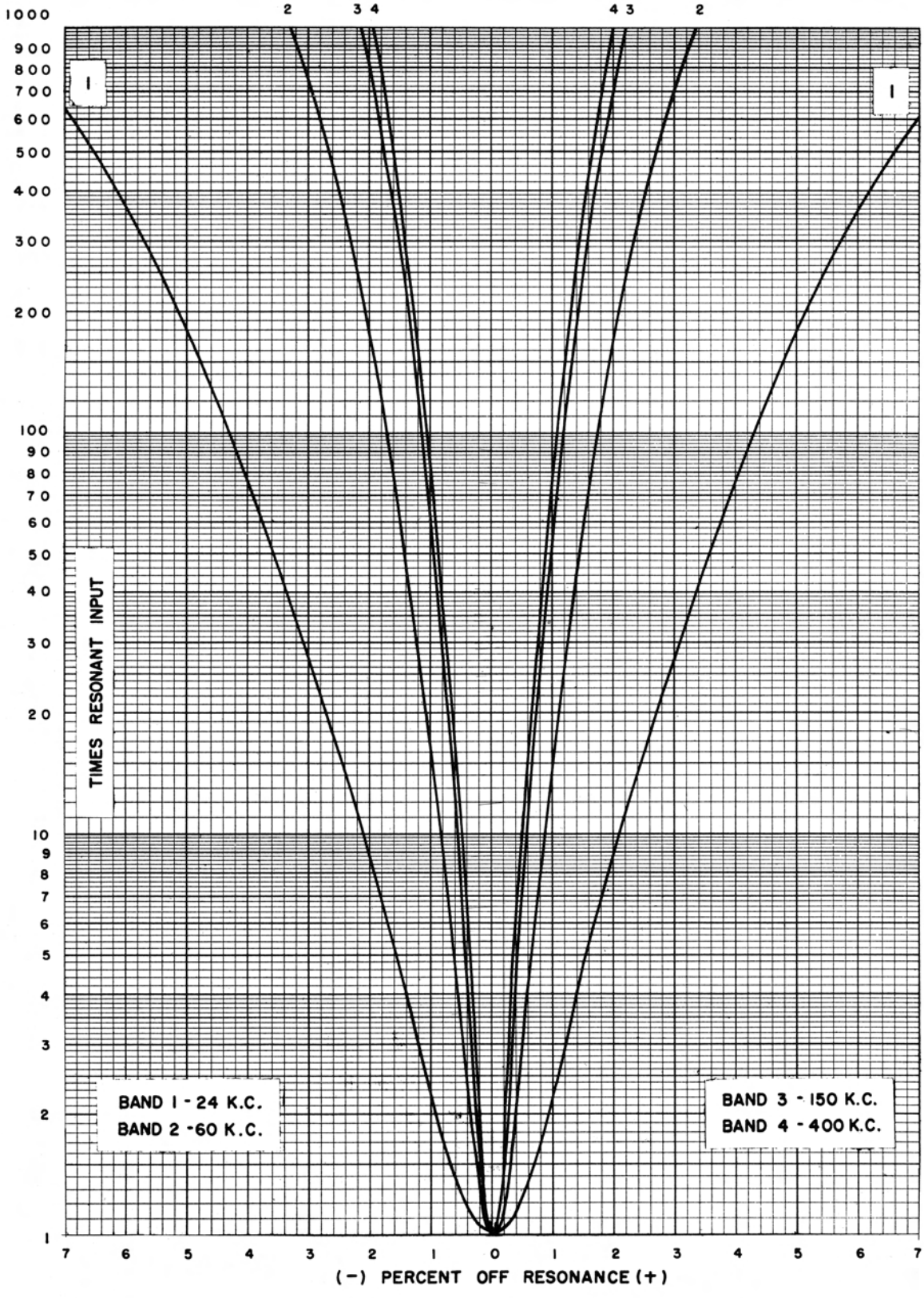



*Figure 7—12. Typical Selectivity, Radio Frequency Amplifier*

(3) Set the INPUT CPLG. switch to 5, the RECEPTION switch to MOD., the AUDIO switch to SHARP, the O.L. switch to OFF, the ADD DECIBELS switch to OFF, and the ANT. COMP. to –2 (two lines to the LEFT of zero).

**Note**

Leave the ANT. COMP. set this way throughout the complete alignment procedure.

(4) Adjust the signal generator to deliver a 600-kc unmodulated signal.

(5) With the receiver thoroughly warmed up set the receiver tuning dial to exactly 600 kc. Adjust the signal generator output, and/or the receiver GAIN control, until the microammeter reads about 150 microamperes or the voltmeter reads about 15 volts.

(6) Loosen the elastic stop nuts on top of the coil assembly shields and rotate the cover discs to expose the various capacitor adjusting screws. Remove the tuning chart and the two thumb screws from the front panel to expose the oscillator coil inductance adjustments. (See figure 7–10.)

(7) Carefully peak each of the Band 1 R-F trimmer capacitors, C-122B, C-124B, C-126B, C-128B (see figures 7–4 and 7–10 for locations), for maximum meter deflection.

**Note**

Keep the meter below 300 microamperes or 30 volts.

Excessive detector output will not damage the receiver in any way, but the resonance indications will be broadened, making precise peaking adjustments difficult. After all four Band 1 trimmers are peaked, repeat step (7) and trim them again.

(8) Reduce the signal generator output. Place the RECEPTION switch on C.W., and the ADD DECIBELS switch on 20. Adjust the Band 1 oscillator trimmer, C-130B, for a 1,000-cps audio beat note as indicated by the peak deflection of the receiver output meter. Check to be sure that the oscillator frequency is higher than the signal generator frequency by decreasing the signal generator frequency and noting that the oscillator frequency increases.

(9) Set the RECEPTION switch to MOD. and the receiver tuning dial to the lowest nominal Band 1 frequency (235 kc). Resonate the signal generator to this exact same frequency as indicated by peak deflection of the detector cathode circuit meter. Set the RECEPTION switch to C.W. Adjust the oscillator coil inductance for a 1,000-cycle beat note, again making sure that the oscillator frequency is higher than the signal frequency.

**CAUTION**

Do not risk damage to the iron-dust core by attempting to force this adjustment beyond its normal range. The total range of adjustment is approximately 7 turns.

The oscillator coil inductance is varied by means of the trimming tool O-103 (for location see figure 7–4) which is inserted in the appropriate one of four holes located on the front panel adjacent to the ADD DECIBELS switch. (These are the holes uncovered in step (6) above.) The inductance decreases and the oscillator frequency increases as the tool is turned clockwise.

(10) Set the RECEPTION switch to MOD. and the receiver dial back on 600 kc. Resonate the signal generator to this same frequency as indicated by peak deflection of the detector cathode circuit meter. Repeat step (8).

(11) Repeat steps (9) and (10) as required. This is necessary because the inductance and capacitance adjustments interact.

(12) Repeat the procedure outlined in steps (4) through (11) for each of the other bands. The trimmers applicable to a particular band are designated by numerals, on the top of the coils for each stage, on figure 7–10. Start aligning each band at the upper nominal frequency of the band. The nominal frequency limits are engraved on the dial mask.

(13) When the alignment is completed close all trimmer holes, tighten the elastic stop nuts, replace the tuning chart and the two thumbscrew plugs, and replace the detector link.

*b.* PARTS REPLACEMENT. — The replacement procedure for most components will be obvious. Those components which require an unusual disassembly procedure, or which are obscured from view by shield covers or other parts, are described below or shown in figures 7–13, 7–14, and 7–15.

(1) LAMPS. — The pilot lamp and the dial lamps used in the CFT-46154-B receiver are of the miniature bayonet-base, twist-to-insert type. The pilot lamp may be made accessible for replacement by unscrewing the red jewel bezel which covers the lamp. The dial lamps may be changed by sliding the front panel forward and then sliding each clip-mounted lamp socket rearward to expose the lamp. After replacing a lamp adjust the position of the lamp socket so that the tuning dial is properly illuminated.

(2) AUDIO COMPONENTS STRIP. — This long bakelite component mounting board may be made accessible for servicing without unsoldering any leads. The connecting leads are long enough so that, when the three securing thumbscrews are removed, it may be partially withdrawn from the chassis. See figure 1–3.

(3) WAVE-BAND SWITCH SECTIONS. — The construction of the wave-band switch permits individual switch sections to be changed without disturbing the wiring or mounting of any of the other sections. Proceed as follows:

(*a*) Carefully remove all wiring from the defective section.

(*b*) Turn the band switch to the "38 to 15 KC" band. Loosen the set screw securing the bandswitch shaft to the drive-shaft coupling and withdraw the shaft through the rear bearing.

(*c*) Loosen either of the retaining screws bearing against the ceramic switch plate and withdraw the switch section.

The rotor assembly may be withdrawn from the switch section after removal of the crescent-shaped spring washer.

When installing a new switch section, proper shaft alignment may be effected by suitably adjusting the two retaining screws bearing against the edges of the switch plate.

(4) COIL ASSEMBLIES. — Access to individual coils of some coil assemblies is obtained by removing the single elastic stop nut on top of the assembly and lifting the shield away from the chassis. Where sufficient access is not provided by this means effect additional disassembly by removing all connecting wires and the two elastic stop nuts on the underside of the chassis. The entire coil assembly may then be removed. Individual coils may thus be tested and serviced in accordance with the data given in table 7–7. In some cases, where it is required to remove individual coils from the assemblies, it may be necessary to loosen one of the coil frame mounting nuts in order to unclamp the coil. In such cases do not use undue force when retightening the mounting nut.

When coils are replaced it may be necessary to follow the alignment procedure outlined in Section 7, paragraph 2 *a*.

(5) FRONT COMPARTMENT SHIELD. — Removal of this shield may be required to facilitate work in the forward section of the chassis, behind the front apron. This removal is accomplished by unmounting capacitor C-111 from one side of the shield, removing the four end screws which hold the shield, and removing the two bottom screws which engage tapped holes in the chassis.

(6) AUXILIARY GAIN CONTROL. — The removal procedure for the auxiliary gain control (R-128) will be obvious upon inspection; however, the replacement procedure requires special precautions as outlined in the following replacement procedure:

(*a*) Mount the new auxiliary gain control, but do not tighten the shaft set screws.

(*b*) Turn the main tuning control (provided with a crank handle) clockwise as far as it will go. (The outer scale of the tuning dial should then read approximately 1,000.)

(*c*) Turn the shaft of the auxiliary gain control all the way counterclockwise (as seen facing the shaft end), then back off one or two degrees.

(*d*) Tighten the shaft set screws. Turn the main tuning control all the way counterclockwise. The tuning dial should now read zero; be sure that the travel limits of the tuning control are determined by the stops associated with the drive mechanism, not by the stops within the auxiliary gain control. If necessary loosen the shaft set screws and readjust the relative angular position of the gain control shaft slightly so that the entire tuning range can be covered.

(*e*) Connect and solder the leads to the auxiliary gain control.

(7) MAIN TUNING CAPACITOR. — The main tuning capacitor is electrically and mechanically protected by a metal shield. Access to the interior of the capacitor is provided by removal of the shield. There should not be any need for further disassembly except in the event of mechanical damage. Should disassembly be required proceed as follows:

(*a*) Using set screw key O-101 loosen the two Allen head screws securing the counterweighted coupling to the drive shaft. Drive out the taper pin by using light hammer blows at the small end of the pin.

(*b*) Invert the chassis and remove the bottom plate.

(*c*) Unsolder the two connections to each of the five capacitor sections.

(*d*) Note that the capacitor is secured to the chassis by means of three fillister-head machine screws, one at the rear and two at the front. The screws are accessible from the bottom side of the chassis. Note also that each mounting screw passes through an adjustable mounting device which has been carefully

positioned at the factory for precise alignment and elevation of the particular tuning capacitor used. This adjustment has been locked by the large hexagon nut; the adjustment should not be disturbed unless a different capacitor is installed. It is only necessary to remove the fillister-head screw when removing the capacitor.

(*e*) Turn the chassis up on its left-hand side (as seen facing the rear). Place the left hand under the rear of the main tuning capacitor, for support, and remove the rear mounting screw.

(*f*) Support the rear of the main tuning capacitor in place, using your hand, to avoid strain on the shafts, and tilt the chassis into its normal position so that it rests on its base and overhangs the edge of the work table by several inches. With the capacitor in its normal position, resting freely on the chassis, remove the two remaining fillister-head capacitor mounting screws.

(*g*) Slide the capacitor directly to the rear, extracting it through the opening provided in the rear wall of the chassis.

(*h*) Reinstallation is the reverse procedure of the disassembly, except that if the original capacitor is not used it will be necessary to readjust the height of the mounting assemblies. This is accomplished by temporarily loosening the lock nuts and changing the height of the threaded spacers, as required, to align the capacitor shaft with the coupling. Make this adjustment with the mounting screws loosely in place and the chassis placed in the normal upright position.

**CAUTION**

When rewiring the capacitor eliminate the probability of dropping solder through the terminal clearance holes by laying the chassis on its side.

(8) TUNING DIAL ASSEMBLY. — Should the tuning dial assembly require repair or replacement use the following procedures:

(*a*) REMOVAL PROCEDURE.

*1.* Set the band switch and tuning dial for 15-kc reception. Remove the band switch and tuning control knobs. Remove the vernier housing and vernier dial.

*2.* Detach the resistor card at the rear of the ADD DECIBELS switch.

*3.* Remove the two chassis withdrawal knobs at the bottom of the front panel.

*4.* Disconnect the two long shafts, running from the front panel controls to S-107 and C-120, at the coupling ends.

*5.* Remove the phone jack shield. Disconnect the phone jack from the front panel by removing the phone jack mounting nut.

*6.* Detach the meter leads. Disconnect all wire-connected front panel controls from the panel, but do not disconnect control wiring. Remove the front panel from the receiver.

*7.* Remove the auxiliary gain control by loosening the control shaft coupling set screw and removing the mounting nut.

*8.* Slide the dial lamp sockets away from the drive assembly.

*9.* Detach the band switch shaft from the detent mechanism by loosening the hexagon set screw and partially withdrawing the shaft towards the rear.

*10.* Remove the four drive assembly mounting screws and carefully disengage the forward part of the coupling.

(*b*) REPLACEMENT PROCEDURE.

*1.* Set the controls on the replacement band switch for 15-kc reception.

*2.* Detach the forward section of the gang capacitor coupling from the old tuning control by driving out the taper pin and loosening the set screw. Mount this coupling section on the new tuning control, tentatively holding it in approximately the position used on the old control by means of light pressure on the set screw.

*3.* Engage the coupling and loosely mount the new control.

*4.* Place the front panel in position, temporarily. Adjust the tuning dial assembly position to be parallel with the front panel with a spacing of 1/32 to 1/16 inch between. Attach the band switch shaft. Tighten the tuning dial assembly mounting screws.

*5.* Loosen the set screw on the gang capacitor forward section coupling. Keeping the main tuning control at 0, turn the assembled gang capacitor coupling to the extreme clockwise position and then back it off about one degree so as to place the gang capacitor in its maximum capacity position while still preventing the rotors from touching the stators. Lock the coupling in this position with the set screw. Test the travel limits of the capacitor and the drive assembly at both ends of the band. If satisfactory, pin the coupling to the tuning control drive shaft with a 3/0 5/8-inch taper pin.

*6.* Reassemble the panel and components. Refer to paragraph 2 *b* (6), above, for the replacement procedure for the auxiliary gain control.

*c.* EMERGENCY REPAIR OF DEFECTIVE COMPONENTS. — Occasion may arise when a replacement component is not available or the time is not available to make a proper repair. In such instances the following TEMPORARY expedients may be used.

(1) AUXILIARY GAIN CONTROL. — Should failure of this control, as a result of an internal open circuit, render the receiver inoperative a temporary repair may be made by short-circuiting the terminals of the control with a jumper. This circuit change may require the operator to turn down the front panel GAIN control when tuned to the high-frequency end of each band in order to avoid receiver oscillation.

(2) MANUAL GAIN CONTROL, R-136B. — Should a worn-out rear section of the GAIN control become noisy or inoperative as the result of an open contact it may be effectively removed from the audio circuit by moving the lead from the center contact over to the high end of the potentiometer. This is the end which is normally contacted by the slider when the GAIN control is set at 100.

(3) OUTPUT LIMITER SWITCH, S-104. — The O.L. switch is a DPDT switch which normally uses only one set of contacts. Should the normally used contacts become defective transfer the switch leads to the remaining set of contacts. Note that a switch sufficiently worn to have one set of bad contacts has usually reached the end of its useful life so far as the other set is concerned.

(4) U.H.F. FILTER CHOKES, L-121, L-122, L-123, L-124. — These chokes are normally required only in the presence of strong radar fields. Where such fields do not provide interference these chokes may be removed from the circuit by short-circuiting their terminals. If required the choke may be rewound by winding a single layer coil of DSC magnet wire (#20 to #30 B&S gauge) over its entire length and connecting the new coil leads to the terminals of the original choke.

(5) COILS. — Table 7–7 provides winding and fabricating data for all coils used in the CFT-46154-B receiver. If the replacement for a defective coil is not available a new coil may be made, using the original coil form, by following the information given. It is preferable, however, to use an original factory replacement coil. Factory produced coils are all tested on the same standard and inductances are held to very close values which insure good tracking of all coils in a given receiver.

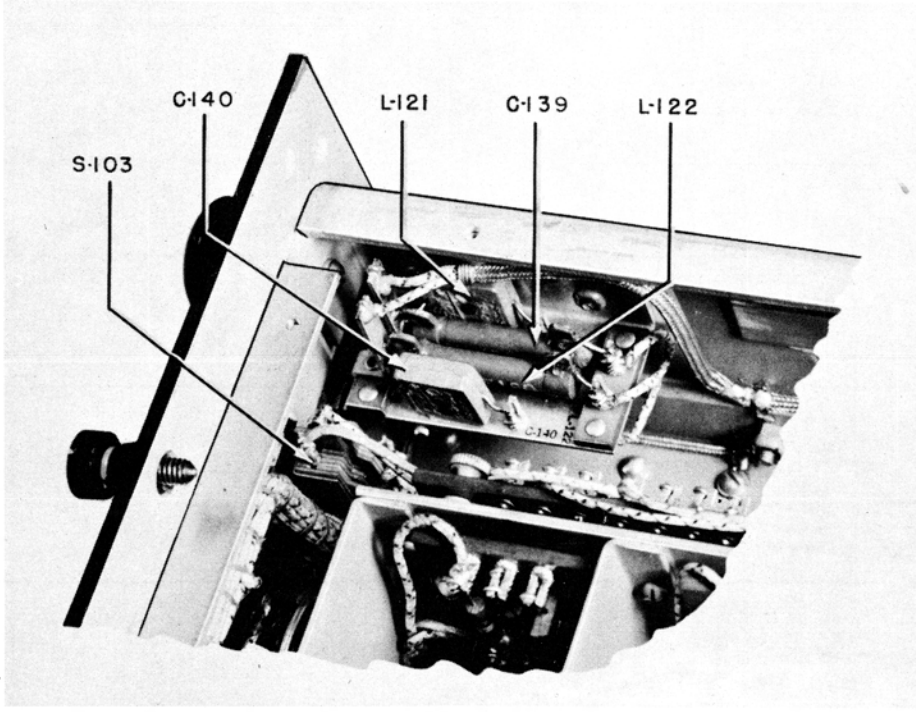
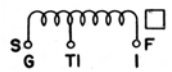
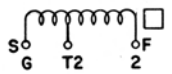
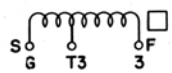
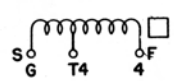
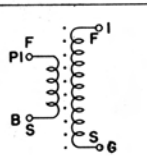
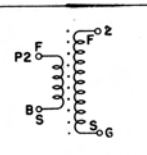
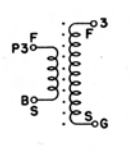
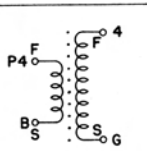


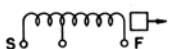
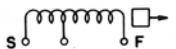
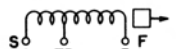
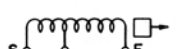
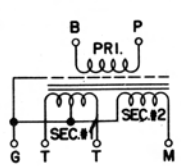

*Figure 7—13. Telephone Jack Filter Cover Removed*

## TABLE 7–7. COIL WINDING DATA*

| DESIGNATION SYMBOL | F. T. R. C. DWG. NO. | DIAGRAM[6] | PART OF COIL ASSEMBLY[1] | WINDING | WIRE SIZE | TURNS | D-C RESISTANCE IN OHMS[3,4] | INDUCTANCE AT 1000 CYCLES | | MACHINE SET UP[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | SHIELDED | UNSHIELDED | CAM | SPINDLE GEAR | CLUTCH GEAR | GAINER |
| L-101 | FRA-32447-3-1 |  | T-101 | | #34 S. S. E. | 2665 Tap at 669 | 135 | 144.2<br>9.37 | 150.8 | ½" S. T. | 60 | 118 | 2.1 |
| L-102 | FRA-32447-3-4 |  | T-101 | | #10/40 S. S. Litz | 1090 Tap at 271 | 25 | 23.2<br>1.565 | 25.1 | ½" S. T. | 70 | 71 | 0.75 |
| L-103 | FRA-32447-3-7 |  | T-102 | | #10/40 D. S. Litz | 377 Tap at 95 | 9 | 3.74<br>0.2533 | 3.894 | 5/16" S. T. | 116 | 60 | 0.25 |
| L-104 | FRA-32447-3-10 |  | T-102 | | #10/40 D. S. Litz | 140 Tap at 36 | 3.1 | 0.598 | 0.617 | ⅛" D. T. | 116 | 60 | 4.0 |
| L-105 or L-109 or L-113 | FRA-32447-3-2 |  | T-103<br>T-105<br>T-107 | Pri. | #32 D. S. | 380 | 13.2 | 3.43 | 3.53 | 3/16" S. T. | 116 | 60 | 1.9 |
| | | | | Sec. | #34 S. D. | 2665 | 135 | 144.2 | 150.8 | ½" S. T. | 60 | 118 | 2.1 |
| L-106 or L-110 or L-114 | FRA-32447-3-5 |  | T-103<br>T-105<br>T-107 | Pri. | #10/40 D. S. Litz | 152 | 3.3 | 0.59 | 0.635 | ½" S. T. | 118 | 40 | 2.7 |
| | | | | Sec. | #10/40 S. S. Litz | 1090 | 25 | 23.2 | 25.1 | ½" S. T. | 70 | 71 | 0.75 |
| L-107 or L-111 or L-115 | FRA-32447-3-8 |  | T-104<br>T-106<br>T-108 | Pri. | #10/40 D. S. Litz | 72 | 1.2 | 0.164 | 0.169 | ⅛" D. T. | 116 | 60 | 4.0 |
| | | | | Sec. | #10/38 S. S. Litz | 389 | 5 | 3.74 | 3.878 | ⅜" S. T. | 70 | 71 | 5.5 |
| L-108 or L-112 or L-116 | FRA-32447-3-11 |  | T-104<br>T-106<br>T-108 | Pri. | #10/40 D. S. Litz | 53 | 0.8 | 0.0925 | 0.0935 | ⅛" D. T. | 116 | 60 | 4.0 |
| | | | | Sec. | #10/40 D. S. Litz | 140 | 3 | 0.598 | 0.617 | ⅛" D. T. | 116 | 60 | 4.0 |

*See footnotes at end of table, page 7-23.

## TABLE 7–7. COIL WINDING DATA (Cont'd)

| DESIGNATION SYMBOL | F. T. R. C. DWG. NO. | DIAGRAM[6] | PART OF COIL ASSEMBLY[1] | WINDING | WIRE SIZE | TURNS | D-C RESISTANCE IN OHMS[3,4] | INDUCTANCE AT 1000 CYCLES | | MACHINE SET UP[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | SHIELDED | UNSHIELDED | CAM | SPINDLE GEAR | CLUTCH GEAR | GAINER |
| L-117 | FRA-32447-3-3 |  | T-109 | | #34 S. S. E. | 2490 Tap at 665 | 140 | 132.1<br>10.22 | 138.4 | ½" S. T. | 60 | 118 | 2.1 |
| L-118 | FRA-32447-3-6 |  | T-109 | | #10/40 S. S. Litz | 1010 Tap at 257 | 25 | 22.3<br>1.5 | 23.32 | ½" S. T. | 70 | 71 | 0.75 |
| L-119 | FRA-32447-3-9 |  | T-110 | | #10/38 S. S. Litz | 387 Tap at 96 | 4.8 | 3.653<br>0.2367 | 3.62 | ⅜" S. T. | 70 | 71 | 5.5 |
| L-120 | FRA-32447-3-12 |  | T-110 | | #10/40 D. S. Litz | 140 Tap at 36 | 2.8 | 0.592<br>0.0440 | 0.611 | ⅛" D. T. | 116 | 60 | 4.0 |
| T-111 | F-25427-1-2 |  | | Pri.<br>Sec. #1<br>Sec. #2 | | | 460[5]<br>3[5]<br>48[5] | The turns ratio of secondary #2 to secondary #1 is 3.16 to 1. The effective primary impedance, with secondary #1 terminated in a 30-ohm resistive load and secondary #2 terminated in a 5,000-ohm resistive load, is 9,000 ohms. | | | | | |

NOTES:
1 For assembly details see schematic diagram, figure 7-16.
2 Coils wound by FTRC on Universal Winding Machine Model 84B manufactured by Universal Winding Machine Co., Providence, R. I.
3 Coil resistance only; does not include series resistor.
4 All resistance measurements on L-101 to L-120 inclusive may be made with units wired in receiver if band switch is rotated so as not to short-circuit the coil. For such measurements, allow for series resistors included in some assemblies as shown in figure 7-16.
5 T-111 may be measured as wired in receiver provided no output load is connected.
6 S and F on diagrams refer to start (inside) lead and finish (outside) lead on the universal wound coils. The color code employed on spare coils designates the lead as follows: Red—Start, Blue—Finish. On two winding coils the smaller winding is the primary. The spacing between primary and secondary windings is 1/16-inch.
7 Impregnation—Immerse universal wound coils in tropicalized Q Max until bubbling ceases. Air dry for one hour, then bake for two hours at 105° to 110°C (221° to 230°F).

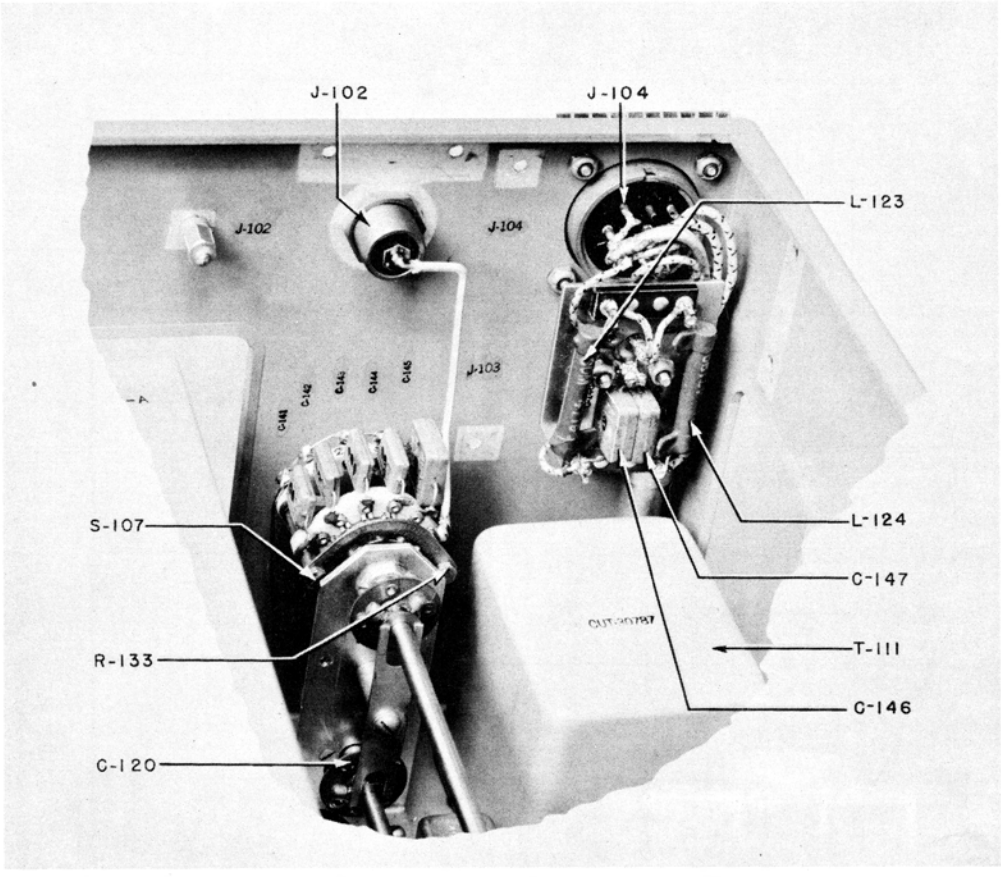



*Figure 7—14. Input Coupling Switch and Output Receptacle Filter (Covers Removed)*

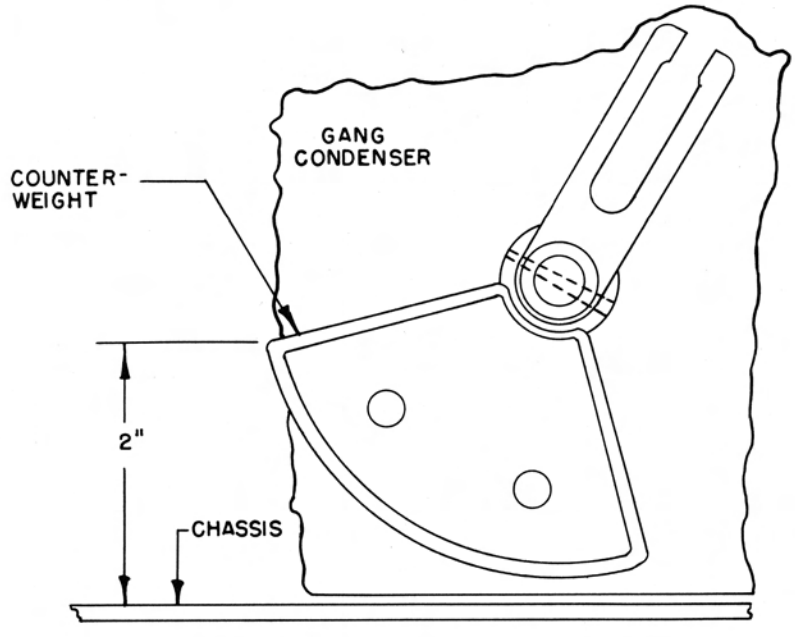



*Figure 7—15. Counterweight Position*

# SECTION 8
# PARTS AND SPARE PARTS LIST (AND MISCELLANEOUS TABLES)

## LIST OF TABLES

*Table 8–1. Weights and Dimensions of Spare Parts Box.*

*Table 8–2. Shipping Weights and Dimensions of Spare Parts Box.*

*Table 8–3. List of Major Units.*

*Table 8–4. Table of Replaceable Parts.*

*Table 8–5. Maintenance Parts Kit.*

*Table 8–6. Cross Reference Parts List.*

*Table 8–7. Color Codes and Miscellaneous Data.*

*Table 8–8. List of Manufacturers.*

## TABLE 8–1. WEIGHTS AND DIMENSIONS OF SPARE PARTS BOX

| EQUIPMENT MAINTENANCE PARTS | | | | | |
|---|---|---|---|---|---|
| SPARE PARTS BOX | OVERALL DIMENSIONS | | | VOLUME (CU. IN.) | WEIGHT (LBS.) |
| | HEIGHT | WIDTH | DEPTH | | |
| #1 | 9-3/16 | 25¾ | 13¼ | 3,156 | 70 |

## TABLE 8–2. SHIPPING WEIGHTS AND DIMENSIONS OF SPARE PARTS BOX

| EQUIPMENT MAINTENANCE PARTS | | | | | | |
|---|---|---|---|---|---|---|
| SHIPPING BOX | SPARE PARTS BOX | OVERALL DIMENSIONS | | | VOLUME (CU. IN.) | WEIGHT (LBS.) |
| | | HEIGHT | WIDTH | DEPTH | | |
| #2 | #1 | 11½ | 27⅞ | 15⅜ | 5,360 | 92 |

## TABLE 8–3. LIST OF MAJOR UNITS.

| SYMBOL GROUP | NAME OF MAJOR UNIT | NAVY TYPE |
|---|---|---|
| 101-199 | Radio Receiving Set | CFT-46154-B |
| 401-499 | Rectifier Power Unit | CBOG-20130-D |

## TABLE 8–4. TABLE OF REPLACEABLE PARTS

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| C-101 | ——— F-16-C-54496-4050 ——— | CAPACITOR, fixed: paper; 3 sect; 250,000 mmf +10% −30% ea sect; 400 vdcw; CAW #430A; CFT dwg F-19749-1-1 | |
| C-101A | ——— | Part of C-101 | 1st RF Cathode By-pass |
| C-101B | ——— | Part of C-101 | 1st RF Screen By-pass |
| C-101C | ——— | Part of C-101 | 1st RF Plate By-pass |
| C-102 | ——— | Same as C-101 | |
| C-102A | ——— | Part of C-102 | 2nd RF Cathode By-pass |
| C-102B | ——— | Part of C-102 | 2nd RF Screen By-pass |
| C-102C | ——— | Part of C-102 | 2nd RF Plate By-pass |
| C-103 | ——— | Same as C-101 | |
| C-103A | ——— | Part of C-103 | 3rd RF Cathode By-pass |
| C-103B | ——— | Part of C-103 | 3rd RF Screen By-pass |
| C-103C | ——— | Part of C-103 | Det Plate By-pass |
| C-104 | ——— | Same as C-101 | |
| C-104A | ——— | Part of C-104 | Det Cathode By-pass |
| C-104B | ——— | Part of C-104 | Det Plate By-pass |
| C-104C | ——— | Part of C-104 | Osc Screen By-pass |
| C-105 | ——— F16-C-53433-4108 ——— | CAPACITOR, fixed: paper; JAN type CP53B4EF254L; 2 sect; 250,000 mmf ±15% ea sect; 600 vdcw; spec JAN-C-25 | |
| C-105A | ——— | Part of C-105 | Negative Feedback to 2nd AF |
| C-105B | ——— | Part of C-105 | Negative feedback to 3rd AF |
| C-106 | ——— | Same as C-105 | |
| C-106A | ——— | Part of C-106 | 1st AF Cathode By-pass |
| C-106B | ——— | Part of C-106 | 1st AF Screen By-pass |
| C-107 | ——— F16-C-49197-3878 ——— | CAPACITOR, fixed: paper; JAN type CP53B1EF205K; 2 mf ±10%; 600 vdcw; spec JAN-C-25 | 3rd AF Plate By-pass |
| C-108 | ——— F16-C-54574-1345 ——— | CAPACITOR, fixed: paper; 3 sect; 500,000 mmf +10% −3% ea sect; 400 vdcw; CFT dwg F-27795-1-1 | |
| C-108A | ——— | Part of C-108 | Main Gain Control By-pass |

## TABLE 8—4 TABLE OF REPLACEABLE PARTS (Cont'd)

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| C-108B | ——— | Part of C-108 | RF Screen By-pass |
| C-108C | ——— | Part of C-108 | Limiter Control By-pass |
| C-109 | F16-C-44257-3124 | CAPACITOR, fixed: paper; JAN type CP53B1EF503K; 50,000 mmf ±10%; 600 vdcw; spec JAN-C-25 | Det Filter Coupling |
| C-110 | F16-C-53192-8190 | CAPACITOR, fixed: paper; JAN type CP53B4EF104L; 2 sect; 100,000 mmf ±15% ea sect; 600 vdcw; spec JAN-C-25 | Output RF By-pass |
| C-110A | ——— | Part of C-110 | Output RF By-pass |
| C-110B | ——— | Part of C-110 | Output RF By-pass |
| C-111 | F16-C-47293-9445 | CAPACITOR, fixed: paper; JAN type CP53B1EE504K; 500,000 mmf ±10%; 400 vdcw; spec JAN-C-25 | Osc P1 Voltage RF By-pass |
| C-112 | F16-C-34545-9856 | CAPACITOR, fixed: mica; 25,000 mmf ±10%; 600 vdcw; per BuShips dwg RE-48A221 type CM50B | #2 Band Osc Pad Section 1 |
| C-113 | ——— | Same as C-109 | 2nd AF Screen By-pass |
| C-114 | F16-C-32646-6808 | CAPACITOR, fixed: mica; JAN type CM35B472K; 4700 mmf ±10%; 500 vdcw; spec JAN-C-5 | Det P1 By-pass |
| C-115 | F16-C-31090-4164 | CAPACITOR, fixed: mica; JAN type CM30B102K; 1000 mmf ±10%; 500 vdcw; spec JAN-C-5 | Osc Coupling |
| C-116 | ——— | Same as C-115 | Osc Grid |
| C-117 | F16-C-30114-4276 | CAPACITOR, fixed: mica; JAN type CM20B471K; 470 mmf ±10%; 500 vdcw; spec JAN-C-5 | 1st AF Coupling |
| C-118 | F16-C-34039-7775 | CAPACITOR, fixed: mica; JAN type CM50B153J; 15,000 mmf ±5%; 600 vdcw; spec JAN-C-5 | #1 Band Osc Pad |
| C-119 | F16-C-27656-2596 | CAPACITOR, fixed: mica; JAN type CM20B510J; 51 mmf ±5%; 500 vdcw; spec JAN-C-5 | Osc Output Equalizing |
| C-120 | F16-C-59827-8921 | CAPACITOR, variable: air; plate meshing type; single sect; 5 mmf min to 50 mmf +20% −5% max; SLC; 0.0195" air gap; CFT dwg #FRA-32442-2-1 | Antenna Compensator |
| C-121 | F16-C-44232-9445 | CAPACITOR, assembly: c/o two var air capacitors mtd on base plate; ea capacitor has max cap of 15 mmf +20% −10%; 0.0195" air gap; SLC; CFT dwg #FRA-32441-2-1 | |

| | | | |
|---|---|---|---|
| C-121A | ——— | Part of C-121 | Ant Trim, Band 1 |
| C-121B | ——— | Part of C-121 | Ant Trim, Band 2 |
| C-122 | ——— | Same as C-121 (p/o T-102) | |
| C-122A | ——— | Part of C-122 | Ant Trim, Band 3 |
| C-122B | ——— | Part of C-122 | Ant Trim, Band 4 |
| C-123 | F16-C-62433-7365 | CAPACITOR ASSEMBLY: c/o two var air capacitors mtd on base plate; ea capacitor 50 mmf +20% −5%; 0.0195" air gap; SLC; CFT dwg #FRA-32441-2-2 | |
| C-123A | ——— | Part of C-123 | 1st RF Trim, Band 1 |
| C-123B | ——— | Part of C-123 | 1st RF Trim, Band 2 |
| C-124 | ——— | Same as C-123 (p/o T-104) | |
| C-124A | ——— | Part of C-124 | 1st RF Trim, Band 3 |
| C-124B | ——— | Part of C-124 | 1st RF Trim, Band 4 |
| C-125 | ——— | Same as C-123 (p/o T-105) | |
| C-125A | ——— | Part of C-125 | 2nd RF Trim, Band 1 |
| C-125B | ——— | Part of C-125 | 2nd RF Trim, Band 2 |
| C-126 | ——— | Same as C-123 (p/o T-106) | |
| C-126A | ——— | Part of C-126 | 2nd RF Trim, Band 3 |
| C-126B | ——— | Part of C-126 | 2nd RF Trim, Band 4 |
| C-127 | ——— | Same as C-123 (p/o T-107) | |
| C-127A | ——— | Part of C-127 | 3rd RF Trim, Band 1 |
| C-127B | ——— | Part of C-127 | 3rd RF Trim, Band 2 |
| C-128 | ——— | Same as C-123 (p/o T-108) | |
| C-128A | ——— | Part of C-128 | 3rd RF Trim, Band 3 |
| C-128B | ——— | Part of C-128 | 3rd RF Trim, Band 4 |
| C-129 | ——— | Same as C-123 (p/o T-109) | |
| C-129A | ——— | Part of C-129 | Osc Trim, Band 1 |
| C-129B | ——— | Part of C-129 | Osc Trim, Band 2 |
| C-130 | ——— | Same as C-123 (p/o T-110) | |
| C-130A | ——— | Part of C-130 | Osc Trim, Band 3 |
| C-130B | ——— | Part of C-130 | Osc Trim, Band 4 |
| C-131 | F16-C-26732-9601 | CAPACITOR, fixed: mica; JAN type CM20C200J; 20 mmf ±5%; 500 vdcw; spec JAN-C-5 | 1st RF Amp Pad |
| C-132 | ——— | Same as C-131 | 2nd RF Amp Pad |

## TABLE 8—4 TABLE OF REPLACEABLE PARTS (Cont'd)

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| C-133 | ——— | Same as C-131 | 3rd RF Amp Pad |
| C-134 | ——— | Same as C-131 | Osc Pad (Shunt) |
| C-135 | ——— | CAPACITOR, variable: air; plate meshing type; 5 sect; 0 to 708 mmf ea sect; modified straight line frequency; 1000 v test, 0.022" air gap; CFT dwg #F-28458-14-2 | |
| | F16-C-63670-1901 | | |
| | ——— | | |
| C-135A | ——— | Part of C-135 | Main Tuning Cap, Ant |
| C-135B | ——— | Part of C-135 | Main Tuning Cap, 1st RF |
| C-135C | ——— | Part of C-135 | Main Tuning Cap, 2nd RF |
| C-135D | ——— | Part of C-135 | Main Tuning Cap, 3rd RF |
| C-135E | ——— | Part of C-135 | Main Tuning Cap, Osc |
| C-136 | ——— | Same as C-114 | 3rd AF Plate By-pass |
| C-137 | ——— | Same as C-112 | #2 Band Osc Pad Sect 2 |
| C-138 | ——— | CAPACITOR, fixed: mica; JAN type CM30B222K; 2200 mmf ±10%; 500 vdcw; spec JAN-C-5 | 2nd AF Coupling |
| | F16-C-31908-1564 | | |
| | ——— | | |
| C-139 | ——— | CAPACITOR, fixed: mica; JAN type CM35B103M; 10,000 mmf ±20%; 300 vdcw; spec JAN-C-5 | UHF Filter |
| | F16-C-33627-7705 | | |
| | ——— | | |
| C-140 | ——— | Same as C-139 | UHF Filter |
| C-141 | ——— | CAPACITOR, fixed: mica; 80 mmf ±10%; 500 vdcw; per BuShips dwg RE-48A-148D type CM20B | Input Coupling |
| | F16-C-28162-4676 | | |
| | ——— | | |
| C-142 | ——— | CAPACITOR, fixed: mica; JAN type CM20B201J; 200 mmf ±5%; 500 vdcw; spec JAN-C-5 | Input Coupling |
| | F16-C-29265-2996 | | |
| | ——— | | |
| C-143 | ——— | CAPACITOR, fixed: mica; JAN type CM20B511J; 510 mmf ±5%; 500 vdcw; spec JAN-C-5 | Input Coupling |
| | F16-C-30188-5001 | | |
| | ——— | | |
| C-144 | ——— | CAPACITOR, fixed: mica; 800 mmf ±10%; 500 vdcw; per BuShips dwg RE-48A148D type CM20B | Input Coupling |
| | F16-C-30694-7076 | | |
| | ——— | | |
| C-145 | ——— | CAPACITOR, fixed: mica; JAN type CM30B202J; 2000 mmf ±5%; 500 vdcw; spec JAN-C-5 | Input Coupling |
| | F16-C-31797-5484 | | |
| | ——— | | |
| C-146 | ——— | Same as C-139 | UHF Filter |
| C-147 | ——— | Same as C-139 | UHF Filter |

| | | | |
|---|---|---|---|
| E-101 | F17-S-690701-140 | BAR, shorting: 1⅜" lg x ⅜" wd x 0.040" thk; hh high brass (hoop brass); 0.0005" cad pl; two #23 holes 0.750" ctrs, one hole cut out at 30 deg to form a hook; CFT dwg #F-26571-1 | Meter Insertion Link |
| E-102 | F17-I-69160-6201 | INSULATOR, standoff: cyl pillar; JAN type NS3W0108; ceramic glazed surface, white steatite L3; 1" lg; ⅜" diam, one #6-32 tapped hole in ea end ⅜" d; spec JAN-I-8 | Insulator |
| E-103 | F17-I-69154-6196 | INSULATOR, standoff: cyl pillar; JAN type NS3W0104; ceramic, white glazed surface, L3 steatite; ½" lg; ⅜" diam w/one #6-32 tapped hole in ea end 3/16" d; spec JAN-I-8 | Insulator |
| E-104 | F17-I-49473-3051 | INSULATOR, bushing: round; white, ceramic; spec JAN-I-10; grade L3A; unglazed and silicon varnish treated; 19/64" o/a lg; shoulder ¼" OD x ⅛" ID x 3/64" lg; shank 3/16" OD x ⅛" ID x ¼" lg; CFT dwg #F-33535-1-3 | Insulator |
| E-105 | F17-I-49473-6001 | INSULATOR, bushing: cylindrical; white, ceramic; spec JAN-I-10; grade L3A; unglazed and silicon varnish treated; 27/64" o/a; shoulder ¼" OD x ⅛" ID x 3/64" lg; shank 3/16" OD x ⅛" ID x ⅜" lg; CFT dwg #F-33535-1-4 | Insulator |
| E-106 | F17-B-77736-9764 | BOARD, coil assembly: ceramic base w/brass term and eyelets attached; round; 2⅜" diam x 9/32" thk, 6 term "L" shape ⅞" lg x ¼" wd; 2 holes 0.180" diam on 23/32" rad from center; p/o T-103, T-104, T-105, T-106, T-107, T-108; CFT dwg #RC-7371-1-4 | Transformer base |
| E-107 | F17-B-77686-9764 | BOARD, coil assembly: ceramic base w/brass term and eyelets attached; round; 2⅜" diam x 9/32" thk, 6 term "L" shape ⅞" lg x ¼" wd; 2 holes 0.180" diam on 23/32" rad from center; p/o T-101, T-102; CFT #RC-7371-1-5 | Transformer base |
| E-108 | F17-B-77686-9769 | BOARD, coil assembly: ceramic base w/brass term and eyelets attached; 2⅜" diam x 9/32" thk, 5 term "L" shape ⅞" lg x ¼" wd; 2 holes 0.180" diam on 23/32" rad from center; p/o T-109, T-110; CFT dwg #RC-7371-1-6 | Transformer base |
| I-101 | G17-L-6297 | LAMP, incandescent: 6 to 8 v, 0.15 amp; tubular bulk; miniature bayonet base; CG #47 | Pilot Lamp |
| I-102 | | Same as I-101 | Dial Lamp |
| I-103 | | Same as I-101 | Dial Lamp |
| J-101 | F17-J-39528-2090 | JACK, telephone: for three cond plug 0.250" diam, 3" lg x 1⅛" wd x ⅝" h o/a; J2 cont arrangement; 0.437" diam mtg hole; CCN; Bu Eng Navy Dept spec RE-13A481E | Phone Output |
| J-102 | F17-C-73411-2793 | CONNECTOR, receptacle: one round male cont; straight type; approx ⅞" diam x 1-5/16" lg o/a excluding term and mtg fl; cylindrical brass body, nickel pl; bakelite insert; mts in ¾" diam chassis cut out; BuShips dwg #RA-49F-215D; CN | Input Jack |
| J-103 | F17-C-73163-6117 | CONNECTOR, receptacle: three round female cont, pol; straight type; 1⅛" diam x 1-3/32" lg o/a; cylindrical cad pl brass shell; bakelite insert; mts in a 27/32" diam drilled hole in chassis; CPH #SP-PC3F | Output Receptacle |
| J-104 | F17-C-72266-8806 | CONNECTOR, receptacle: AN-3102-28-4S; nine round female cont, pol; straight type; 2" h x 2" wd x 1-5/16" d; cylindrical aluminum body w/sq fl for mtg; bakelite insert four 0.147" diam mtg holes on 1-9/16" x 1-9/16" mtg/c; MIL-C-5015; CPH #AN-3102-28-4S | Power Receptacle |

## TABLE 8—4 TABLE OF REPLACEABLE PARTS (Cont'd)

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| L-101 | F16-C-75627-1932 | COIL, RF: antenna coil, band 1; single universal pie wnd; unshielded; 2665 turns #34 SS enamel wire tapped at 669 turns; 1⅜" diam x 2⅝" lg; bakelite form, powdered iron core; screw mtd by end of coil form; loose leads soldered in assembly; Q max impr (p/o T-101); CFT dwg #FRA-32487-1-1 | Antenna Coil, Band #1 |
| L-102 | F16-C-75351-2923 | COIL, RF: antenna coil, band 2; single universal pie wnd; unshielded; 1090 turns #10/40 SS Litz wire tapped at 271 turns; 2-1/16" lg x 1⅜" wd x 1⅜" h o/a; bakelite dowel, powdered iron core; loose leads soldered in assembly; Q max impr (p/o T-101); CFT dwg #FRA-32486-1-1 | Antenna Coil, Band #2 |
| L-103 | F16-C-76754-8043 | COIL, RF: antenna coil, band 3; single universal pie wnd; unshielded; 377 turns #10/40 DS Litz wire tapped at 95 turns; 1-31/32" lg x 1⅞" diam; ceramic coil form, adj iron core; axial Allen wrench adj; loose leads soldered in assembly; Q max impr (p/o T-102); CFT dwg #FRA-32447-3-7 | Antenna Coil, Band #3 |
| L-104 | F16-C-76702-3449 | COIL, RF: antenna coil, band 4; single universal pie wnd; unshielded; 140 turns #10/40 DS Litz wire tapped at 36 turns; 1-31/32" lg x 1-15/16" diam; ceramic coil form, adj iron core; axial Allen wrench adj; loose leads soldered in assembly; Q max impr (p/o T-102); CFT dwg #FRA-32447-3-10 | Antenna Coil, Band #4 |
| L-105 | F17-T-81982-9801 | COIL, RF: amplifier, band 1; two wnd, single pie wnd; unshielded; coil X 380 turns #32 DS wire, coil Y 2665 turns #34 SSE wire; 1⅜" diam x 2⅝" lg o/a; powdered iron core, bakelite form; loose leads soldered in assembly; Q max impr (p/o T-103, T-105, T-107); CFT dwg #FRA-32487-1-2 | |
| L-105A | | Part of L-105 | 1st RF Coil, Band 1 Pri |
| L-105B | | Part of L-105 | 1st RF Coil, Band 1 Sec |
| L-106 | F17-T-82106-1205 | COIL, RF: amplifier, band 2; two wnd, single pie wnd; unshielded; coil X 152 turns #10/40 DS Litz wire; coil Y 1090 turns #10/40 SS Litz wire; 2-1/16" lg x 1⅜" wd x 1⅜" h o/a; bakelite dowel, powdered iron core; loose leads soldered in assembly; Q max impr (p/o T-103, T-105, T-107); CFT dwg #FRA-32486-1-2 | |
| L-106A | | Part of L-106 | 1st RF Coil, Band 2 Pri |
| L-106B | | Part of L-106 | 1st RF Coil, Band 2 Sec |
| L-107 | F17-T-81950-2273 | COIL, RF: amplifier, band 3; two wnd, single pie wnd; unshielded; coil X 72 turns #10/40 DS Litz wire, coil Y 389 turns #10-38 SS Litz wire; 1-31/32" lg x 1⅞" wd x 1⅞" h o/a; ceramic coil form, powdered iron core; axial Allen wrench adj; loose leads soldered in assembly; Q max impr (p/o T-104, T-106, T-108); CFT dwg #FRA-32447-3-8 | |
| L-107A | | Part of L-107 | 1st RF Coil, Band 3 Pri |
| L-107B | | Part of L-107 | 1st RF Coil Band 3 Sec |
| L-108 | F17-T-81946-4401 | COIL, RF: amplifier, band 4; two wnd, single pie wnd; unshielded; coil X 53 turns #10/40 DS Litz wire, coil Y 140 turns #10/40 DS Litz wire; 1-31/32" lg x 1-15/16" diam; ceramic coil form, adj powdered iron core; axial Allen wrench adj; loose leads soldered in assembly; Q max impr (p/o T-104, T-106, T-108); CFT dwg #FRA-32447-3-11 | |

| | | | |
|---|---|---|---|
| L-108A | ——— | Part of L-108 | 1st RF Coil, Band 4 Pri |
| L-108B | ——— | Part of L-108 | 1st RF Coil, Band 4 Sec |
| L-109 | ——— | Same as L-105 (p/o T-105) | |
| L-109A | ——— | Part of L-109 | 2nd RF Coil, Band 1 Pri |
| L-109B | ——— | Part of L-109 | 2nd RF Coil, Band 1 Sec |
| L-110 | ——— | Same as L-106 (p/o T-105) | |
| L-110A | ——— | Part of L-110 | 2nd RF Coil, Band 2 Pri |
| L-110B | ——— | Part of L-110 | 2nd RF Coil, Band 2 Sec |
| L-111 | ——— | Same as L-107 (p/o T-106) | |
| L-111A | ——— | Part of L-111 | 2nd RF Coil, Band 3 Pri |
| L-111B | ——— | Part of L-111 | 2nd RF Coil, Band 3 Sec |
| L-112 | ——— | Same as L-108 (p/o T-106) | |
| L-112A | ——— | Part of L-112 | 2nd RF Coil, Band 4 Pri |
| L-112B | ——— | Part of L-112 | 2nd RF Coil, Band 4 Sec |
| L-113 | ——— | Same as L-105 (p/o T-107) | |
| L-113A | ——— | Part of L-113 | 3rd RF Coil, Band 1 Pri |
| L-113B | ——— | Part of L-113 | 3rd RF Coil, Band 1 Sec |
| L-114 | ——— | Same as L-106 (p/o T-107) | |
| L-114A | ——— | Part of L-114 | 3rd RF Coil, Band 2 Pri |
| L-114B | ——— | Part of L-114 | 3rd RF Coil, Band 2 Sec |
| L-115 | ——— | Same as L-107 (p/o T-108) | |
| L-115A | ——— | Part of L-115 | 3rd RF Coil, Band 3 Pri |
| L-115B | ——— | Part of L-115 | 3rd RF Coil, Band 3 Sec |
| L-116 | ——— | Same as L-108 (p/o T-108) | |
| L-116A | ——— | Part of L-116 | 3rd RF Coil, Band 4 Pri |
| L-116B | ——— | Part of L-116 | 3rd RF Coil, Band 4 Sec |
| L-117 | ——— | | |
| | F16-C-76867-5825 | COIL, RF: oscillator; single wnd, 1 pie universal wnd; unshielded; 2490 turns #34 SSE wire, tapped at 665 turns; 1½" diam x 1-31/32" lg; ceramic form, adj iron core; axial Allen wrench adj; loose leads soldered in assembly; Q max impr (p/o T-109); CFT dwg #FRA-32447-3-3 | Oscillator Coil, Band 1 |
| | ——— | | |
| L-118 | ——— | | |
| | F16-C-76786-3953 | COIL, RF: oscillator; single wnd, 1 pie universal wnd; unshielded; 1010 turns #10/40 SS Litz wire tapped at 257 turns; 1⅜" diam x 1-31/32" lg; ceramic coil form, adj iron core; axial Allen wrench adj; loose leads soldered in assembly; Q max impr (p/o T-109); CFT dwg #FRA-32447-3-6 | Oscillator Coil, Band 2 |
| | ——— | | |

## TABLE 8-4 TABLE OF REPLACEABLE PARTS (Cont'd)

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| L-119 | F16-C-76754-6761 | COIL, RF: oscillator; single wnd, 1 pie universal wnd; unshielded; 387 turns #10/38 SS Litz wire tapped at 96 turns; 1⅞" diam x 1-31/32" lg; ceramic coil form, adj iron core; axial Allen wrench adj; loose leads soldered in assembly; Q max impr (p/o T-110); CFT dwg #FRA-32447-3-9 | Oscillator Coil, Band 3 |
| L-120 | F16-C-76702-2585 | COIL, RF: oscillator; single wnd, 1 pie universal wnd; unshielded; 140 turns #10/40 DS Litz wire tapped at 36 turns; 1-15/16" diam x 1-31/32" lg; ceramic coil form; adj iron core; axial Allen wrench adj; loose leads soldered in assembly; Q max impr (p/o T-110); CFT dwg #FRA-32447-3-12 | Oscillator Coil, Band 4 |
| L-121 | F16-C-73012-3351 | COIL, RF: choke; single wnd; unshielded, rated 5.5 microhenrys at 1 amp DC, 0.85 ohms DC resistance, 60 turns #28-E wire; 1¾" lg x 5/16" OD o/a excluding term; air core; two pigtail term used for mtg; COM #Z-1; CFT dwg #F-28850-1-2 | UHF Filter |
| L-122 | | Same as L-121 | UHF Filter |
| L-123 | | Same as L-121 | UHF Filter |
| L-124 | | Same as L-121 | UHF Filter |
| M-101 | F17-M-35537-9157 | METER, voltmeter: DC type; range 0 to 250 v; round, metal flush mtd case; 2.06" diam max bbl, 1.51" d max behind fl, 2.55" max diam, round fl; 2% accuracy for full scale reading; D'Arsonval movement; 200 ohms per volt; calibrated for non-magnetic panel; 25 scale divisions, black numerals on buff background; self contained; three mtg holes for #4 screw spaced 120 deg apart on 1.16" rad; two stud term 17/32" lg x #8-32 thd; anti-glare and shatterproof glass; Navy Dept spec 17112 (INT); CV #506; CFT dwg #FRS-32489-1 | Plate Voltmeter |
| M-102 | F17-M-22712-9231 | METER, audio level: AC rect type; range −10 db in 2 db steps to +5 db in 1 db steps; round, metal flush mtd case; 2.06" diam max bbl, 1.51" d max behind fl, 2.55" diam max, round fl; 5% accuracy for full scale reading; D'Arsonval movement; 1.06 v sensitivity, reference level 0.6 volt; calibrated for non-magnetic panel; black numerals on buff background; self-contained; three mtg holes for #4 screws spaced 120 deg apart on 1.16" rad; two stud term 17/32" lg x #8-32 thd; anti-glare and shatterproof glass, reference level 72 microwatts; Navy Dept spec 17112 (INT); CV #506; CFT dwg #FRS-32490-1 | Output Meter |
| O-101 | G41-W-2449 | KEY, set screw; ordnance finish; AM #10 | |
| O-102 | G41-W-2446 | KEY, set screw; ordnance finish; AM #8 | |
| O-103 | F16-T-751329-701 | TOOL, alignment: bakelite and brass body; 6" lg x 3/16" diam o/a; 1/16" metal hex side wrench one end, opposite end plain; CFT dwg #F-26621-1-2 | Osc Coil Core Adjustment |
| O-104 | F17-M-75138-3501 | MOUNT, vibration: square mtg, normal load rating 25 lbs, maximum load rating 50 lbs; 2¼" lg x 2¼" wd x 1" thk o/a; rubber vibration cushion 2" | Shock Absorption |

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|---|---|---|---|
| | ——— | diam x 1" h mtg concentrically; metal bushing in center of rubber cushion provided w/0.391" bolt hole; four mtg holes 0.196" on 1¾" x 1¾" mtg/c; CAXP #200P25 | |
| O-105 | ——— F17-M-98378-3871 ——— | COUPLING, flexible: canvas, bakelite ins; 1/16" OD to fit ¼" shaft w/four 6-32 x 3/16" lg fil hd cup point steel set screw; CFT dwg #F-29858-1 | Shaft Coupling |
| O-106 | ——— F17-S-46747-9241 ——— | SPRING: helical extension type; #15 music wire; 1-11/32" lg x 13/64" diam; inner diam of loop 3/16"; cad pl; CFT dwg #F-24544-1-2 | Detent Spring |
| O-107 | ——— F17-S-46724-5345 ——— | SPRING: helical extension type; #11 music wire; 35/64" lg x 3/16" diam; 15½ turns, close wnd; cad pl; CFT dwg #F-19647-1-2 | Gear Loading |
| O-108 | ——— F17-B-77-5001-139 ——— | BUSHING: tube shock-mount; pure gum rubber; male; shoulder 1/16" thk x 7/16" diam, shank 1/16" thk x ¼" diam, inner hole 9/64" diam; CFT dwg #F-29693-1 | Shock Absorption |
| O-109 | ——— G33-W-310-90 ——— | WASHER, flat: pure gum rubber; round 9/64" ID, 7/16" OD, 1/16" thk; CFT dwg #F-29694 | Shock Absorption |
| O-110 | ——— F16-D-901161-131 ——— | DRIVE, dial: tuning radio receiver and indicating tuned frequency; two knobs on front; 10⅜" h x 7¾" wd x 4" d o/a incl shaft projections; 4 mtg holes, two on 7" diam dial, calibrated 0-1000; CFT dwg #RC-3715-14-2 | RF Tuning and Band Selection Drive |
| O-111 | ——— F16-C-637001-102 ——— | COUNTERWEIGHT: comprises a hub, counterweight in shape of 90 deg sector on one side and a radial slotted arm on opposite side; arm and hub, SS; counterweight, Alcoa alloy #195-T-4 casting filled w/lead; 4⅜" x 3-5/16" x 7⅛" o/a; single axial hole in hub, for ⅜" diam shaft; CFT dwg #RC-4717-1-2 | Capacitor Counterbalance |
| O-112 | ——— F16-A-700161-115 ——— | ARM ASSEMBLY: flexible coupling between tuning capacitor and dial drive; driving arm, driving pin; bronze casting, SS pin; circular hub w/rectangular extension arm; driving pin, 11/32" lg x ¼" wd, driving arm, 2½" lg x ⅝" wd x ⅜" thk; single axial hole in hub attaching to shaft with set screw and taper pin; CFT dwg #RC-4719-1 | Coupling Dial Drive to Capacitor Assembly |
| O-113 | ——— F16-R-503580-212 ——— | RETAINER, tube: SS; used w/one post; 1-3/16" diam x 7/32" h for T-9 glass envelopes and all metal envelopes except MT-10; CACA #2T | Tube Retainer |
| O-114 | ——— | RETAINER, tube: SS; 1¼" diam x ⅝" h; for T-9 glass envelopes; CAIS 926-B36 | Tube Retainer |
| P-101 | ——— F17-C-71464-5859 ——— | CONNECTOR, plug: 3 round male cont, pol; straight type; 1-7/16" lg x ⅞" diam o/a excluding term and cable guard; cont rated 15 amp at 125 v; cylindrical brass body, chrome pl; molded black bakelite insert; 0.281" diam cable opening; has spring cable guard; CPH #MC3M | Output Plug |
| P-102 | ——— F17-C-71117-7063 ——— | CONNECTOR, plug: single female cont; round; hexagonal end; non-polarized: straight type; 2-15/16" lg x 13/16" diam o/a; cylindrical; brass body; locking type; bakelite insert; 17/32" diam cable opening; Navy Dept BuShips dwg #RA-49F-216B; CN | Transmission Line |
| P-103 | ——— F17-C-71107-8086 ——— | ADAPTER, connector: male one end, female other end; one round male cont, one round female cont; straight type; connects NT-49120 jack (J-102) w/telephone plug; 21/32" lg x 11/16" diam o/a; knurled nickel pl brass body; mts by one #10-32 thd x 5/16" lg stud; Navy Dept BuShips dwg #RA-49AA-225-A; CN | Antenna Adapter |

## TABLE 8-4 TABLE OF REPLACEABLE PARTS (Cont'd)

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| P-104 | F17-A-27451-1012 | ADAPTER, connector: 90 deg angle type; adapts NT-49160 plug (P-101) to Navy TTHFA-1 cable; 1⅝" lg x 1¼" h x ⅞" d o/a; cylindrical brass body; lam phenolic insert ½" diam cable opening; has cable clamp on one end and ⅝"-27 thd ferrule on other end for coupling to NT-49160; Navy Dept BuShips dwg #RE-49AA-297; CFT dwg #RC-7366-2 | Plug Adapter |
| R-101 | F16-R-49922-811 | RESISTOR, fixed: comp; JAN type RC20BF102K; 1000 ohms ±10%; ½ w; spec JAN-R-11 | 1st RF Cathode |
| R-102 | ——— | Same as R-101 | 2nd RF Cathode |
| R-103 | F16-R-50039-811 | RESISTOR, fixed: comp; JAN type RC20BF272K; 2700 ohms ±10%; ½ w; spec JAN-R-11 | 3rd RF Cathode |
| R-104 | F16-R-50282-811 | RESISTOR, fixed: comp; JAN type RC20BF103K; 10,000 ohms ±10%; ½ w; spec JAN-R-11 | 1st RF Screen |
| R-105 | ——— | Same as R-104 | 2nd RF Screen |
| R-106 | ——— | Same as R-104 | 3rd RF Volt |
| R-107 | ——— | Same as R-103 | 1st RF Plate |
| R-108 | ——— | Same as R-103 | 2nd RF Plate |
| R-109 | F16-R-50634-231 | RESISTOR, fixed: comp; JAN type RC30BF104K; 100,000 ohms ±10%; 1 w; spec JAN-R-11 | 3rd RF Divider |
| R-110 | F16-R-50633-811 | RESISTOR, fixed: comp; JAN type RC20BF104K; 100,000 ohms ±10%; ½ w; spec JAN-R-11 | Det Cathode |
| R-111 | ——— | Same as R-110 | Det Plate |
| R-112 | F16-R-50066-811 | RESISTOR, fixed: comp; JAN type RC20BF332K; 3300 ohms ±10%; ½ w; spec JAN-R-11 | LP Filter Pad |
| R-113 | ——— | Same as R-112 | LP Filter Pad |
| R-114 | F16-R-50012-811 | RESISTOR, fixed: comp; JAN type RC20BF222K; 2200 ohms ±10%; ½ w; spec JAN-R-11 | AF Gain Control Limit |
| R-115 | F16-R-49985-811 | RESISTOR, fixed: comp; JAN type RC20BF182K; 1800 ohms ±10%; ½ w; spec JAN-R-11 | 1st AF Cathode |
| R-116 | F16-R-50372-811 | RESISTOR, fixed: comp; JAN type RC20BF223K; 22,000 ohms ±10%; ½ w; spec JAN-R-11 | 1st AF Screen |

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|---|---|---|---|
| R-117 | ——— | Same as R-109 | 1st AF Screen |
| R-118 | F16-R-50741-811 | RESISTOR, fixed: comp; JAN type RC20BF274K; 270,000 ohms ±10%; ½ w; spec JAN-R-11 | 1st AF Plate |
| R-119 | F16-R-50858-811 | RESISTOR, fixed: comp; JAN type RC20BF564K; 560,000 ohms ±10%; ½ w; spec JAN-R-11 | 3rd AF Grid |
| R-120 | F16-R-49822-751 | RESISTOR, fixed: comp; JAN type RC30BF621J; 620 ohms ±5%; 1 w; spec JAN-R-11 | 3rd RF Cathode |
| R-121 | F16-R-49923-231 | RESISTOR, fixed: comp; JAN type RC30BF102K; 1000 ohms ±10%; 1 w; spec JAN-R-11 | 3rd AF Plate |
| R-122 | F16-R-50678-811 | RESISTOR, fixed: comp; JAN type RC20BF154K; 150,000 ohms ±10%; ½ w; spec JAN-R-11 | LP Filter Pad |
| R-123 | F16-R-50282-331 | RESISTOR, fixed: comp; JAN type RC41BF103J; 10,000 ohms ±5%; 2 w; spec JAN-R-11 | OL Divider |
| R-124 | ——— | Same as R-110 | Osc Grid Leak |
| R-125 | F16-R-50714-811 | RESISTOR, fixed: comp; JAN type RC20BF224K; 220,000 ohms ±10%; ½ w; spec JAN-R-11 | Osc Screen |
| R-126 | F16-R-50975-811 | RESISTOR, fixed: comp; JAN type RC20BF105K; 1 megohm ±10%; ½ w; spec JAN-R-11 | 2nd AF Screen |
| R-127 | ——— | Same as R-110 | Osc Plate |
| R-128 | F16-R-90835-90000 | RESISTOR, variable: WW; 2000 ohms ±10% linear; 3 w; linear taper; CMC #P58-2000; CFT dwg #F-28793-1-1 | Aux Gain Control |
| R-129 | F16-R-68357-5766 | RESISTOR, fixed: WW; JAN type RU3B101J; 100 ohms ±5%; ½ w; spec JAN-R-184 | Voltage Divider |
| R-130 | ——— | Same as R-123 | Voltage Divider |
| R-131 | ——— | Same as R-123 | Voltage Divider |
| R-132 | ——— | Same as R-123 | Osc Coupling |
| R-133 | ——— | Same as R-119 | Static Drain |
| R-134 | ——— | Same as R-104 | Osc Pad Shunt |
| R-135 | ——— | Same as R-104 | Osc Pad Shunt |
| R-136 | F16-R-88857-5501 | RESISTOR, variable: WW; 5000/28,000 ohms; 1½ w ea sect ±15%; 5000 ohms sect, 200 ohms at 30% counterclockwise rotation, RH taper, 28,000 ohms sect, 400 ohms at 70% clockwise rotation, LH taper; CMC Dual P58; CFT dwg #F-28791-1-1 | |

## TABLE 8–4 TABLE OF REPLACEABLE PARTS (Cont'd)

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| R-136A | ——— | Part of R-136 | RF Gain |
| R-136B | ——— | Part of R-136 | AF Gain |
| R-137 | F16-R-91288-4960 | RESISTOR, variable: WW; 10,000 ohms ±5%; 2 w; LH log taper; CMC #P58; CFT dwg #F-28792-1-1 | Output Level Control |
| R-138 | F16-R-50065-431 | RESISTOR, fixed: comp; JAN type RC20BF332J; 3300 ohms ±5%; ½ w; spec JAN-R-11 | Output Meter Multiplier |
| R-139 | F16-R-49930-431 | RESISTOR, fixed: comp; JAN type RC20BF112J; 1100 ohms ±5%; ½ w; spec JAN-R-11 | Output Meter Multiplier |
| R-140 | F16-R-68373-1486 | RESISTOR, fixed: WW; JAN type RU3B331J; 330 ohms ±5%; ½ w; spec JAN-R-184 | Output Meter Multiplier |
| R-141 | F16-R-68364-2646 | RESISTOR, fixed: WW; JAN type RU3B161J; 160 ohms ±5%; ½ w; spec JAN-R-184 | Output Meter Multiplier |
| R-142 | F16-R-49723-431 | RESISTOR, fixed: comp; JAN type RC20BF361J; 360 ohms ±5%; ½ w; spec JAN-R-11 (p/o T-101) | Damping Band 1 |
| R-143 | ——— | Same as R-141 | Output Meter Multiplier |
| R-144 | F16-R-68376-4426 | RESISTOR, fixed: WW; JAN type RU3B391J; 390 ohms ±5%; ½ w; spec JAN-R-184 | Output Meter Multiplier |
| R-145 | F16-R-49984-431 | RESISTOR, fixed: comp; JAN type RC20BF182J; 1800 ohms ±5%; ½ w; spec JAN-R-11 | Output Meter Multiplier |
| R-146 | ——— | Same as R-142 (p/o T-103) | Damping Band 1 |
| R-147 | F16-R-50399-811 | RESISTOR, fixed: comp; JAN type RC20BF273K; 27,000 ohms ±10%; ½ w; spec JAN-R-11 | AC Hum Filter |
| R-148 | ——— | Same as R-142 (p/o T-105) | Damping Band 1 |
| R-149 | F16-R-49967-811 | RESISTOR, fixed: comp; JAN type RC20BF152K; 1500 ohms ±10%; ½ w; spec JAN-R-11 | 2nd AF Cathode |
| R-150 | F16-R-50894-811 | RESISTOR, fixed: comp; JAN type RC20BF684K; 680,000 ohms ±10%; ½ w; spec JAN-R-11 | Negative Feedback |
| R-151 | ——— | Same as R-118 | 2nd AF Plate |

| | | | |
|---|---|---|---|
| R-152 | ——— | Same as R-110 | Negative Feedback |
| R-153 | F16-R-50822-811 | RESISTOR, fixed: comp; JAN type RC20BF474K; 470,000 ohms ±10%; ½ w; spec JAN-R-11 | 2nd AF Grid |
| R-154 | ——— | Same as R-142 (p/o T-107) | Damping Band 1 |
| R-155 | F16-R-68330-9246 | RESISTOR, fixed: WW; JAN type RU3B330J; 33 ohms ±5%; ½ w; spec JAN-R-184 (p/o T-101) | Damping Band 2 |
| R-156 | ——— | Same as R-155 (p/o T-103) | Damping Band 2 |
| R-157 | ——— | Same as R-155 (p/o T-105) | Damping Band 2 |
| R-158 | ——— | Same as R-155 (p/o T-107) | Damping Band 2 |
| S-101 | F17-S-70773-3564 | SWITCH, toggle: SPST; 3 amp, 125 v DC; laminated phenolic body construction, black nickel finish; 1⅜" lg x ½" wd x 9/16" deep excluding bushing and handle; 9/16" lg bat type handle; solder lug term; single hole mtg bushing 15/32"-32 thd, ⅝" lg; CHH; per BuShips dwg RE-24AA118A, fig 2 | Receiver ON-OFF |
| S-102 | ——— | Same as S-101 | Osc ON-OFF |
| S-103 | F17-S-74049-5952 | SWITCH, toggle: DPDT; 3 amp, 125 v DC; laminated phenolic body construction, black nickel finish; 1⅜" lg x ½" wd x 9/16" d not including solder lug bushing and handle; 9/16" lg bat type handle; solder lug term; single hole mtg bushing 15/32"-32 thd; ⅝" lg; CHH; per BuShips dwg RE-24AA118, fig 3 | Filter Switch |
| S-104 | ——— | Same as S-103 | OL Switch |
| S-105 | F17-S-59309-5697 | SWITCH, rotary: 2 pole 5 position; single sect; rotor cont solid coin silver; ceramic body; 1⅞" diam x 1" d; solder lug term; bushing ⅜" lg, shaft diam ¼" x 13/16" lg; spring return from extreme CCW position; CFT dwg #FRE-32439-1; COC | Output Meter Multiplier |
| S-106 | F17-S-91697-1007 | SWITCH SECTION, rotary: frequency band change; single rectangular ceramic wafer; 3 poles, 4 positions, 4 throws, 12 cont; ceramic wafer, solid coin silver cont; square wafer w/corners rounded on 3/16" to ⅜" rad; 2-1/16" wd x 2⅜" lg x 1-1/16" thk o/a; four 5/16" diam holes on 1⅞" and 2⅛" mtg ctrs; stamped "F-21664-1" on edge; CRV; CFT dwg #F-21664-1 | |
| S-106A | ——— | Part of S-106, listed for reference only | Band Switch Ant Tap |
| S-106B | ——— | Part of S-106, listed for reference only | Band Switch Ant Shorting |
| S-106C | ——— | Part of S-106, listed for reference only | Band Switch Ant Sec |
| S-107 | F17-S-63680-9605 | SWITCH, rotary; single circuit, five positions; two sect; rotor cont solid coin silver; ceramic body; 1-29/32" diam x 1¾" d; shorting type cont; extra dummy sect; shaft 9/16" lg x ¼" diam; CFT dwg #FRE-32437-1; COC | Input Coupling |
| S-108 | ——— | Same as S-106, listed for reference only | |
| S-108A | ——— | Part of S-108, listed for reference only | Band Switch 1st RF Pri |
| S-108B | ——— | Part of S-108, listed for reference only | Band Switch 1st RF Short |
| S-108C | ——— | Part of S-108, listed for reference only | Band Switch 1st RF Sec |
| S-109 | ——— | Same as S-106, listed for reference only | |
| S-109A | ——— | Part of S-109, listed for reference only | Band Switch RF Pri |

## TABLE 8—4 TABLE OF REPLACEABLE PARTS (Cont'd)

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| S-109B | ——— | Part of S-109, listed for reference only | Band Switch 2nd RF Short |
| S-109C | ——— | Part of S-109, listed for reference only | Band Switch 2nd RF Sec |
| S-110 | ——— | Same as S-106, listed for reference only | |
| S-110A | ——— | Part of S-110, listed for reference only | Band Switch 3rd RF Pri |
| S-110B | ——— | Part of S-110, listed for reference only | Band Switch 3rd RF Short |
| S-110C | ——— | Part of S-110, listed for reference only | Band Switch 2nd RF Sec |
| S-111 | ——— | Same as S-106, listed for reference only | |
| S-111A | ——— | Part of S-111, listed for reference only | Band Switch Osc Tap |
| S-111B | ——— | Part of S-111, listed for reference only | Band Switch Osc Short |
| S-111C | ——— | Part of S-111, listed for reference only | Band Switch Osc Sec |
| T-101 | ——— F16-R-33591-1243 ——— | RECEIVER SUBASSEMBLY, radio: antenna coils, bands 1 and 2; 2 wnd, universal wnd; shield not supplied; 2665 turns #34 SS enamel wire tapped at 669 turns, 1090 turns #10/40 SS Litz wire tapped at 271 turns; 6" lg x 2½" diam o/a; powdered iron core; trimmer shaft through top of can; Q max impr; incl L-101, L-102, C-121, R-142, R-155; CFT dwg #FRA-32448-14-1 | Ant Transf Assem Bands 1 and 2 |
| T-102 | ——— F16-R-33591-1245 ——— | RECEIVER SUBASSEMBLY, radio: antenna coils, bands 3 and 4; 2 wnd, universal wnd; shield not supplied; 337 turns #10/40 DS Litz wire tapped at 95 turns, 140 turns #10/40 DS Litz wire tapped at 36 turns; 6" lg x 2½" diam o/a; ceramic form, iron core; trimmer shaft through top of can; Q max impr; incl L-103, L-104, C-122; CFT dwg #FRA-32448-14-2 | Ant Transf Assem Bands 3 and 4 |
| T-103 | ——— F16-R-33591-1246 ——— | RECEIVER SUBASSEMBLY, radio: amplifier coils, bands 1 and 2, pri and sec; 4 wnd, universal wnd; shield not supplied; 380 turns #32 DS wire, 2665 turns #34 SSE wire, 152 turns #10/40 DS Litz wire, 1090 turns #10/40 SS Litz wire; two wnd on same iron dust core, two wnd on same iron core; trimmer shaft through top of can; Q max impr; incl L-105, L-106, C-123, R-146, R-156; CFT dwg #FRA-32448-14-3 | 1st RF Transf Assem Bands 1 and 2 |
| T-104 | ——— F16-R-33591-1251 ——— | RECEIVER SUBASSEMBLY, radio: amplifier coils, bands 3 and 4, pri and sec; 4 wnd, universal wnd; shield not supplied; 72 turns #10/40 DS Litz wire, 389 turns #10/38 SS Litz wire, 53 turns #10/40 DS Litz wire, 140 turns #10/40 DS Litz wire; 6" lg x 2½" diam o/a; two wnd on same iron core, two wnd on same ceramic coil form, iron core; coil form ½" diam x 2" lg; built-in trimmer capacitor; trimmer shaft through top of can; Q max impr; incl L-107, L-108, C-124; CFT dwg #FRA-32448-14-4 | 1st RF Transf Assem Bands 3 and 4 |
| T-105 | ——— F16-R-33591-1242 ——— | Same as T-103 except coil mtg bkt stamped "L-109, L-110, C-125, T-105", underside of coil base stamped "T-105"; incl L-109, L-110, C-125, R-148, R-157 | 2nd RF Transf Assem Bands 1 and 2 |
| T-106 | ——— F16-R-33591-1249 ——— | Same as T-104 except coil mtg bkt stamped "L-111, L-112, C-126, T-106", underside of coil base stamped "T-106"; incl L-111, L-112, C-126 | 2nd RF Transf Assem Bands 3 and 4 |

| | | | |
|---|---|---|---|
| T-107 | F16-R-33591-1247 | Same as T-103 except coil mtg bkt stamped "L-113, L-114, C-127, T-107", underside of coil base stamped "T-107"; incl L-113, L-114, C-127, R-154, R-158 | 3rd RF Transf Assem Bands 1 and 2 |
| T-108 | F16-R-33591-1250 | Same as T-104 except coil mtg bkt stamped "L-115, L-116, C-128, T-108", underside of coil base stamped "T-108"; incl L-115, L-116, C-128 | 3rd RF Transf Assem Bands 3 and 4 |
| T-109 | F16-R-33591-1252 | RECEIVER SUBASSEMBLY, radio: oscillator coils, bands 1 and 2; 2 wnd, universal wnd; shield not supplied; 2490 turns #34 SSE wire tapped at 665 turns, 1010 turns #10/40 SS Litz wire tapped at 257 turns; 6" lg x 2½" diam o/a; ceramic form, iron core; built-in trimmer capacitor; trimmer shaft through top of can; Q max impr; incl L-117, L-118, C-129; CFT dwg #FRA-32448-14-5 | Osc Transf Assem Bands 1 and 2 |
| T-110 | F16-R-33591-1248 | RECEIVER SUBASSEMBLY, radio: oscillator coils, bands 3 and 4; 2 wnd, universal wnd; shield not supplied; 387 turns #10/38 SS Litz wire tapped at 96 turns, 140 turns #10/40 DS Litz wire tapped at 36 turns; 6" lg x 2½" diam o/a; ceramic form, iron core; built-in trimmer capacitor; trimmer shaft through top of can; Q max impr; incl L-119, L-120, C-134; CFT dwg #FRA-32448-14-6 | Osc Transf Assem Bands 3 and 4 |
| T-111 | F17-T-65193-3041 | TRANSFORMER, AF: plate coupling type; pri operates from 9000 ohm source, secd #1 CT to gnd operates into 30 ohm load, secd #2 one side gnd operates into 5000 ohm load; HS metal case, iron core; 3½" lg x 2¾" wd x 2½" h o/a excluding term; 1.5 w max oper level of secd #1 turns ratio pri to secd #1, 17.3 to 1, pri to secd #2, 1.3 to 1; freq response flat within 1.5 db from 200 to 1300 cyc; gnd electrostatic shield between pri and secd wnd; six solder lug term on top; four #6–32 tapped inserts on 2¾" x 2" mtg/c on top; CUT; CFT dwg #F-25427-1-2 | Output Transf |
| V-101 | F17-L-6806-120 | LAMP, glow: T-2 bulb, unbased; CG #NE-2 | RF Over-Voltage Protection |
| V-102 | F16-T-56674 | TUBE, electron: JAN-6SK7W; pentode; spec JAN-1A | 1st RF Amp |
| V-103 | | Same as V-102 | 2nd RF Amp |
| V-104 | | Same as V-102 | 3rd RF Amp |
| V-105 | F16-T-56355 | TUBE, electron: JAN-6J5WGT; triode; spec JAN-1A | Detector |
| V-106 | | Same as V-102 | Oscillator |
| V-107 | F16-T-56667-50 | TUBE, electron: JAN-6SJ7WGT; pentode; spec JAN-1A | 1st AF Amp |
| V-108 | | Same as V-107 | 2nd AF Amp |
| V-109 | F16-T-56410 | TUBE, electron: JAN-6K6-GT/G; beam power tetrode; spec JAN-1A | 3rd AF Amp |
| XI-101 | F17-L-76854-3966 | LIGHT, indicator: with lens; ½" red jewel w/anti-glare disk 0.421" diam x 0.015" thk bakelite paper; miniature bayonet base type; bulb style T-3¼; 6 to 8 v, 150 milliamperes; back of panel 1-3/16" lg x approx ⅞" wd; CFT dwg #F-28790-1 | Pilot Light |

## TABLE 8—4 TABLE OF REPLACEABLE PARTS (Cont'd)

| REFERENCE DESIGNATION | STOCK NOS. (1) SIGNAL CORPS (2) STANDARD NAVY (3) AIR CORPS | NAME AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| XI-102 | F17-L-77696-3814 | LIGHT, panel: assembly; approx o/a dimen 1½" lg x 11/16" wd; clip bkt made of phosphor-bronze spring temper; shell made of drawn brass cad pl; one lamp, miniature bayonet type base; 6 to 8 v, 150 milliamperes; two solder lug term riveted to bottom shell; CFT dwg #F-19870-1 | Dial Light |
| XI-103 | ——— | Same as XI-102 | |
| XV-101 | ——— | Not used | |
| XV-102 | F16-S-63471-2924 | SOCKET, tube: eight cont octal; below chassis wafer mtg; two 0.170" wd mtg slots on 1-11/16" to 1-27/32" mtg/c; oval ceramic body 2-5/16" lg x 1-11/16" wd x ¼" h o/a excluding term; phosphor bronze silver pl cont; cont separated from base by cloth base lam ins; per BuShips spec RE-13A-524B; CEJ #228 | 1st RF Tube Socket |
| XV-103 | ——— | Same as XV-102 | 2nd RF Tube Socket |
| XV-104 | ——— | Same as XV-102 | 3rd RF Tube Socket |
| XV-105 | ——— | Same as XV-102 | Detector Tube Socket |
| XV-106 | ——— | Same as XV-102 | Oscillator Tube Socket |
| XV-107 | ——— | Same as XV-102 | 1st AF Tube Socket |
| XV-108 | ——— | Same as XV-102 | 2nd AF Tube Socket |
| XV-109 | ——— | Same as XV-102 | 3rd AF Tube Socket |
| Z-101 | F16-F-44035-6429 | FILTER, low pass: attenuation 6 db max at 1300 cps, 40 db min at 1650 cps, 40 db attenuation of any freq above 1700 cyc; approx case dim 3¾" lg x 3" wd x 3½" h; input and output impedances 30,000 ohms, ins test 1500 v AC; rectangular metal case; mts by four #6-32 tapped inserts on 2" x 2¾" mtg/c; three solder lug term at bottom; HS case, CUT; CFT dwg #F-19469-1-2 | Low-pass Filter |
| Z-102 | F16-F-32089-2588 | FILTER, band-pass: peak freq 1000 cps ±5%, bandwidth for 6 db attenuation not less than 180 cyc, for 40 db not more than 450 cyc; approx case dim 3¾" lg x 3" wd x 5⅛" h; input and output impedance 30,000 ohms, bandwidth 910 to 1090 cps; rectangular metal can; mts by four #6-32 tapped inserts on 2" x 2¾" mtg/c; three solder lug term; attenuation for any freq below 725 cyc or above 1250 cyc is not less than 40 db; CUT; CFT dwg #F-19485-1-2 | Band-pass Filter |

## TABLE 8–5. MAINTENANCE PARTS KIT

| KEY DESIGNATION | QUANT. | KEY DESIGNATION | QUANT. |
|---|---|---|---|
| C-121 | 1 | L-120 | 1 |
| E-106 | 1 | O-103 | 1 |
| E-107 | 1 | O-106 | 1 |
| E-108 | 1 | O-107 | 1 |
| L-101 | 1 | S-105 | 1 |
| L-102 | 1 | S-106 | 1 |
| L-103 | 1 | S-107 | 1 |
| L-104 | 1 | T-111 | 1 |
| L-105 | 1 | Z-101 | 1 |
| L-106 | 1 | Z-102 | 1 |
| L-107 | 1 | L-401 | 1 |
| L-108 | 1 | L-405 | 1 |
| L-117 | 1 | T-401 | 1 |
| L-118 | 1 | W-401 | 1 |
| L-119 | 1 | | |

## TABLE 8–6. CROSS REFERENCE PARTS LIST

| JAN (OR AWS) DESIGNATION | KEY SYMBOL |
|---|---|
| CM20B201J | C-142 |
| CM20B471K | C-117 |
| CM20B510J | C-119 |
| CM20B511J | C-143 |
| CM20C200J | C-131 |
| CM30B102K | C-115 |
| CM30B202J | C-145 |
| CM30B222K | C-138 |
| CM35B103M | C-139 |
| CM35B472K | C-114 |
| CM50B153J | C-118 |
| CP53B1EE504K | C-111 |
| CP53B1EF205K | C-107 |
| CP53B1EF503K | C-109 |
| CP53B4EF104L | C-110 |
| CP53B4EF254L | C-105 |
| NS3W0104 | E-103 |
| NS3W0108 | E-102 |
| RC20BF102K | R-101 |
| RC20BF103K | R-104 |
| RC20BF104K | R-110 |
| RC20BF105K | R-126 |
| RC20BF112J | R-139 |
| RC20BF152K | R-149 |
| RC20BF154K | R-122 |
| RC20BF182J | R-145 |
| RC20BF182K | R-115 |
| RC20BF222K | R-114 |
| RC20BF223K | R-116 |
| RC20BF224K | R-125 |
| RC20BF272K | R-103 |
| RC20BF273K | R-147 |
| RC20BF274K | R-118 |
| RC20BF332J | R-138 |
| RC20BF332K | R-112 |
| RC20BF361J | R-142 |
| RC20BF474K | R-153 |
| RC20BF564K | R-119 |
| RC20BF684K | R-150 |
| RC30BF102K | R-121 |
| RC30BF104K | R-109 |
| RC30BF621J | R-120 |
| RC41BF103J | R-123 |

| JAN (OR AWS) DESIGNATION | KEY SYMBOL |
|---|---|
| RU3B101J | R-129 |
| RU3B161J | R-141 |
| RU3B330J | R-155 |
| RU3B331J | R-140 |
| RU3B391J | R-144 |
| JAN-6J5WGT | V-105 |
| JAN-6K6-GT/G | V-109 |
| JAN-6SJ7WGT | V-107 |
| JAN-6SK7W | V-102 |

| NAVY TYPE | KEY SYMBOL |
|---|---|
| (-30787) | T-111 |
| (-49021A) | J-101 |
| (-49120) | J-102 |
| (-49161) | J-103 |
| (-49121) | P-102 |
| (-49152) | P-103 |
| (-49509) | P-104 |
| (-49367) | X-102 |
| (-53088) | Z-101 |
| (-53089) | Z-102 |
| (-47190) | L-121 |
| (-481371) | C-108 |
| (-481372) | C-101 |
| (-48591-B10) | C-112 |
| (-481165-B5) | C-118 |
| (-481368-B10) | C-141 |
| (-631089-L10) | R-128 |
| (-631090-M15) | R-136 |
| (-631091-M5) | R-137 |

| ARMY-NAVY TYPE | KEY SYMBOL |
|---|---|
| AN-3102-28-4S | J-104 |

| STANDARD NAVY STOCK NO. | KEY SYMBOL |
|---|---|
| F16-A-700161-115 | O-112 |
| F16-C-26732-9601 | C-131 |
| F16-C-27656-2596 | C-119 |

| STANDARD NAVY STOCK NO. | KEY SYMBOL |
|---|---|
| F16-C-28162-4676 | C-141 |
| F16-C-29265-2996 | C-142 |
| F16-C-30114-4276 | C-117 |
| F16-C-30188-5001 | C-143 |
| F16-C-30694-7076 | C-144 |
| F16-C-31090-4164 | C-115 |
| F16-C-31797-5484 | C-145 |
| F16-C-31908-1564 | C-138 |
| F16-C-32646-6808 | C-114 |
| F16-C-33627-7705 | C-139 |
| F16-C-34039-7775 | C-118 |
| F16-C-34545-9856 | C-112 |
| F16-C-44232-9445 | C-121 |
| F16-C-44257-3124 | C-109 |
| F16-C-47293-9445 | C-111 |
| F16-C-49197-3878 | C-107 |
| F16-C-53192-8190 | C-110 |
| F16-C-53433-4108 | C-105 |
| F16-C-54496-4050 | C-101 |
| F16-C-54574-1345 | C-108 |
| F16-C-59827-8921 | C-120 |
| F16-C-62433-7365 | C-123 |
| F16-C-63670-1901 | C-135 |
| F16-C-637001-102 | O-111 |
| F16-C-73012-3351 | L-121 |
| F16-C-75351-2923 | L-102 |
| F16-C-75627-1932 | L-101 |
| F16-C-76702-2585 | L-120 |
| F16-C-76702-3449 | L-104 |
| F16-C-76754-6761 | L-119 |
| F16-C-76786-3953 | L-118 |
| F16-C-76867-5825 | L-117 |
| F16-D-901161-131 | O-110 |
| F16-F-32089-2588 | Z-102 |
| F16-F-44035-6429 | Z-101 |
| F16-R-33591-1242 | T-105 |
| F16-R-33591-1243 | T-101 |
| F16-R-33591-1245 | T-102 |
| F16-R-33591-1246 | T-103 |
| F16-R-33591-1247 | T-107 |
| F16-R-33591-1248 | T-110 |
| F16-R-33591-1249 | T-106 |
| F16-R-33591-1250 | T-108 |

| STANDARD NAVY STOCK NO. | KEY SYMBOL |
|---|---|
| F16-R-33591-1251 | T-104 |
| F16-R-33591-1252 | T-109 |
| F16-R-49723-431 | R-142 |
| F16-R-49822-751 | R-120 |
| F16-R-49922-811 | R-101 |
| F16-R-49923-231 | R-121 |
| F16-R-49930-431 | R-139 |
| F16-R-49967-811 | R-149 |
| F16-R-49984-431 | R-145 |
| F16-R-49985-811 | R-115 |
| F16-R-50012-811 | R-114 |
| F16-R-50039-811 | R-103 |
| F16-R-50065-431 | R-138 |
| F16-R-50066-811 | R-112 |
| F16-R-50282-331 | R-123 |
| F16-R-50282-811 | R-104 |
| F16-R-503580-212 | O-113 |
| F16-R-50372-811 | R-116 |
| F16-R-50399-811 | R-147 |
| F16-R-50633-811 | R-110 |
| F16-R-50634-231 | R-109 |
| F16-R-50678-811 | R-122 |
| F16-R-50714-811 | R-125 |
| F16-R-50741-811 | R-118 |
| F16-R-50822-811 | R-153 |
| F16-R-50858-811 | R-119 |
| F16-R-50894-811 | R-150 |
| F16-R-50975-811 | R-126 |
| F16-R-68330-9246 | R-155 |
| F16-R-68357-5766 | R-129 |
| F16-R-68364-2646 | R-141 |
| F16-R-68373-1486 | R-140 |
| F16-R-68376-4426 | R-144 |
| F16-R-88857-5501 | R-136 |
| F16-R-90835-90000 | R-128 |
| F16-R-91288-4960 | R-137 |
| F16-S-63471-2924 | XV-102 |
| F16-T-56355 | V-105 |
| F16-T-56410 | V-109 |
| F16-T-56667-50 | V-107 |
| F16-T-56674 | V-102 |
| F16-T-751329-701 | O-103 |
| F17-A-27451-1012 | P-104 |

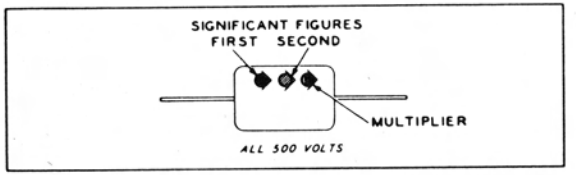
## TABLE 8–6. CROSS REFERENCE PARTS LIST (Cont'd)

| STANDARD NAVY STOCK NO. | KEY SYMBOL |
|---|---|
| F17-B-77-5001-139 | O-108 |
| F17-B-77686-9764 | E-107 |
| F17-B-77686-9769 | E-108 |
| F17-B-77736-9764 | E-106 |
| F17-C-71107-8086 | P-103 |
| F17-C-71117-7063 | P-102 |
| F17-C-71464-5859 | P-101 |
| F17-C-72266-8806 | J-104 |
| F17-C-73163-6117 | J-103 |
| F17-C-73411-2793 | J-102 |
| F17-I-49473-3051 | E-104 |
| F17-I-49473-6001 | E-105 |
| F17-I-69154-6196 | E-103 |
| F17-I-69160-6201 | E-102 |
| F17-J-39528-2090 | J-101 |
| F17-L-6806-120 | V-101 |
| F17-L-76854-3966 | XI-101 |
| F17-L-77696-3814 | XI-102 |
| F17-M-22712-9231 | M-102 |
| F17-M-35537-9157 | M-101 |
| F17-M-75138-3501 | O-104 |
| F17-M-98378-3871 | O-105 |
| F17-S-46724-5345 | O-107 |
| F17-S-46747-9241 | O-106 |
| F17-S-59309-5697 | S-105 |
| F17-S-63680-9605 | S-107 |
| F17-S-690701-140 | E-101 |
| F17-S-70773-3564 | S-101 |
| F17-S-74049-5952 | S-103 |
| F17-S-91697-1007 | S-106 |
| F17-T-65193-3041 | T-111 |
| F17-T-81946-4401 | L-108 |
| F17-T-81950-2273 | L-107 |
| F17-T-81982-9801 | L-105 |
| F17-T-82106-1205 | L-106 |
| G17-L-6297 | I-101 |
| G33-W-310-90 | O-109 |
| G41-W-2446 | O-102 |
| G41-W-2449 | O-101 |

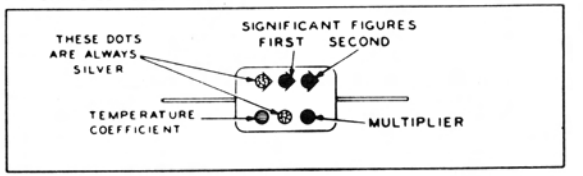
# TABLE 8–7. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

## CAPACITOR COLOR CODES

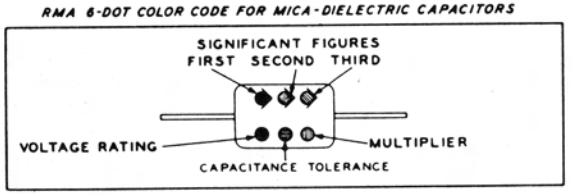
*RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS*



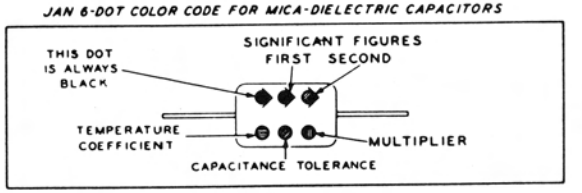

*JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS*



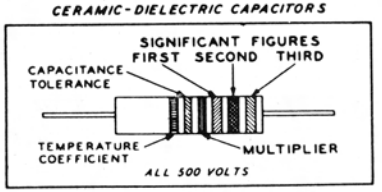

*RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS*




*JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS*

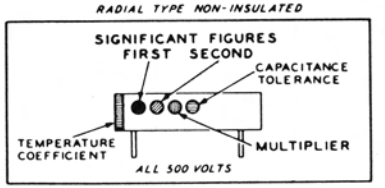



*RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS*

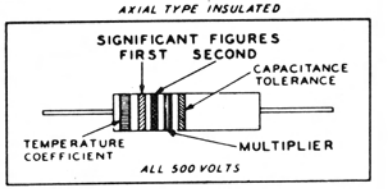



*JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS*

*RADIAL TYPE NON-INSULATED*




*AXIAL TYPE INSULATED*



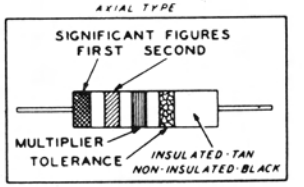

*RMA: RADIO MANUFACTURERS ASSOCIATION*
*JAN: JOINT ARMY-NAVY*

| RESISTORS | | CAPACITORS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | MULTIPLIER | | | | |
| TOLERANCE | MULTIPLIER | SIGNIFICANT FIGURE | COLOR | RMA MICA AND CERAMIC-DIELECTRIC | JAN MICA AND PAPER-DIELECTRIC | JAN CERAMIC DIELECTRIC | VOLTAGE RATING | TEMPERATURE COEFFICIENT |
| | 1 | 0 | BLACK | 1 | 1 | 1 | | A |
| | 10 | 1 | BROWN | 10 | 10 | 10 | 100 | B |
| | 100 | 2 | RED | 100 | 100 | 100 | 200 | C |
| | 1,000 | 3 | ORANGE | 1,000 | 1000 | 1000 | 300 | D |
| | 10,000 | 4 | YELLOW | 10,000 | | | 400 | E |
| | 100,000 | 5 | GREEN | 100,000 | | | 500 | F |
| | 1,000,000 | 6 | BLUE | 1,000,000 | | | 600 | G |
| | 10,000,000 | 7 | VIOLET | 10,000,000 | | | 700 | |
| | 100,000,000 | 8 | GRAY | 100,000,000 | | 0.01 | 800 | |
| | 1,000,000,000 | 9 | WHITE | 1,000,000,000 | | 0.1 | 900 | |
| 5 | 0.1 | | GOLD | 0.1 | 0.1 | | 1000 | |
| 10 | 0.01 | | SILVER | 0.01 | 0.01 | | 2000 | |
| 20 | | | NO COLOR | | | | 500 | |

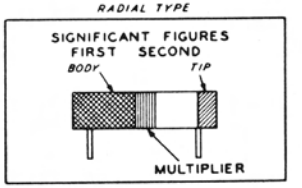
## RESISTOR COLOR CODES

*RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*

*AXIAL TYPE*

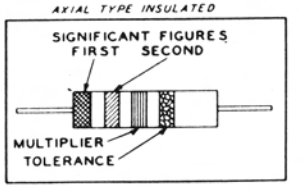



*RADIAL TYPE*

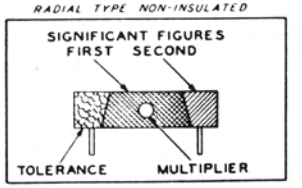



*JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS*

*AXIAL TYPE INSULATED*




*RADIAL TYPE NON-INSULATED*



## TABLE 8—8. LIST OF MANUFACTURERS

| PREFIX | NAME | ADDRESS |
|---|---|---|
| CAIS | The Birtcher Corp. | 5087 Huntington Drive, Los Angeles, Calif. |
| CAW | Aerovox Corp. | 742 Belleville Ave., New Bedford, Mass. |
| CAXP | Lord Mfg. | 1639 W. 12th St., Erie, Pa. |
| CBOG | National Electronics Laboratories, Inc. | 1713 Kalorama Road, Washington 9, D. C. |
| CED | Cannon Electric Development Co. | 3291 Humboldt St., Los Angeles 31, Calif. |
| CEJ | Johnson, E. F. Co. | Waseca, Minn. |
| CFT | Federal Telephone & Radio Corp. | 100 Kingsland Road, Clifton, N. J. |
| CFW | Sickles, F. W. Co. | Springfield, Mass. |
| CG | General Electric Co. | 1 River Road, Schenectady 5, N. Y. |
| CHH | Arrow-Hart & Hegeman Electric Co. | 102 Hawthorne St., Hartford, Conn. |
| CLJ | Langevin Co., Inc. | 37 West 65th St., New York, N. Y. |
| CN | National Electrical Mach. Shops, Inc. | 919 Jesup-Blair Drive, Silver Spring, Md. |
| COC | Oak Mfg. | 1200 N. Clybourne Ave., Chicago, Ill. |
| COM | Ohmite Mfg. Co. | 4835 W. Flournoy St., Chicago, Ill. |
| CPH | American Phenolic Corp. | 1830 South 54th Ave., Chicago, Ill. |
| CRC | RCA Mfg. Co. | (Radiotron Div.) Harrison, N. J. |
| CRV | RCA Victor Div. of RCA | Camden, N. J. |
| CSR | Russell & Stoll Co. | 125 Barclay St., New York, N. Y. |
| CUT | United Transformer Corp. | 148 Varick St., New York, N. Y. |
| CV | Weston Electrical Instrument Corp. | 619 Frelinghuysen Ave., Newark, N. J. |
| CYA | Alden Products | 117 N. Main St., Brockton, Mass. |

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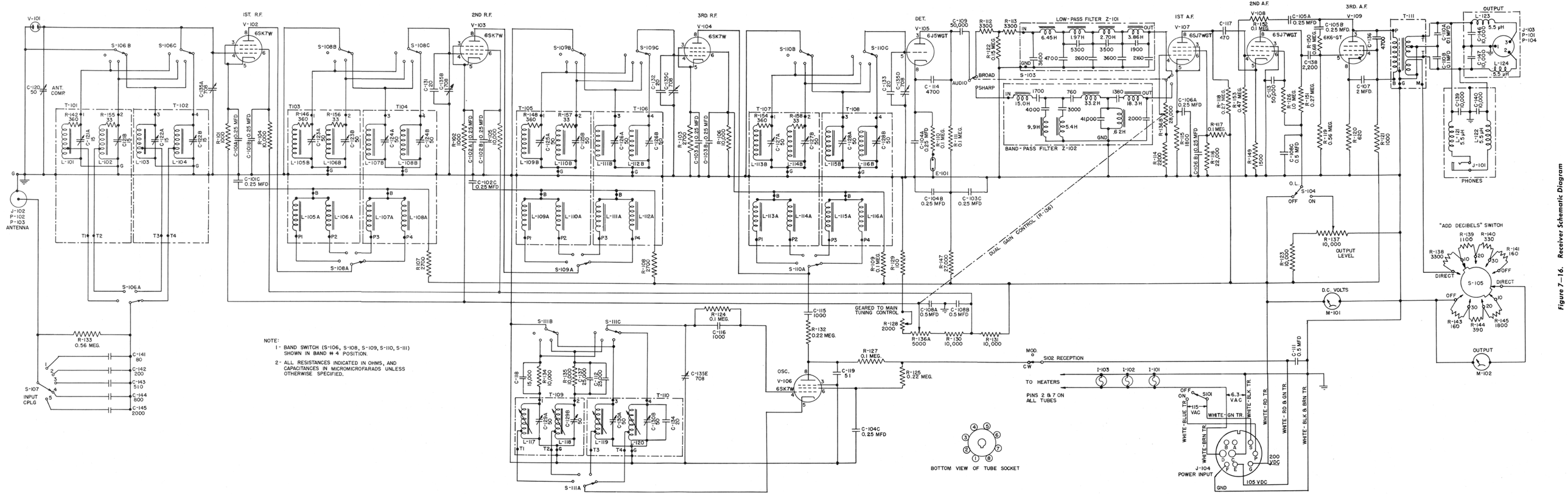


NOTE:
1- BAND SWITCH (S-106, S-108, S-109, S-110, S-111) SHOWN IN BAND # 4 POSITION.

2- ALL RESISTANCES INDICATED IN OHMS, AND CAPACITANCES IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED.

*Figure 7–16. Receiver Schematic Diagram*

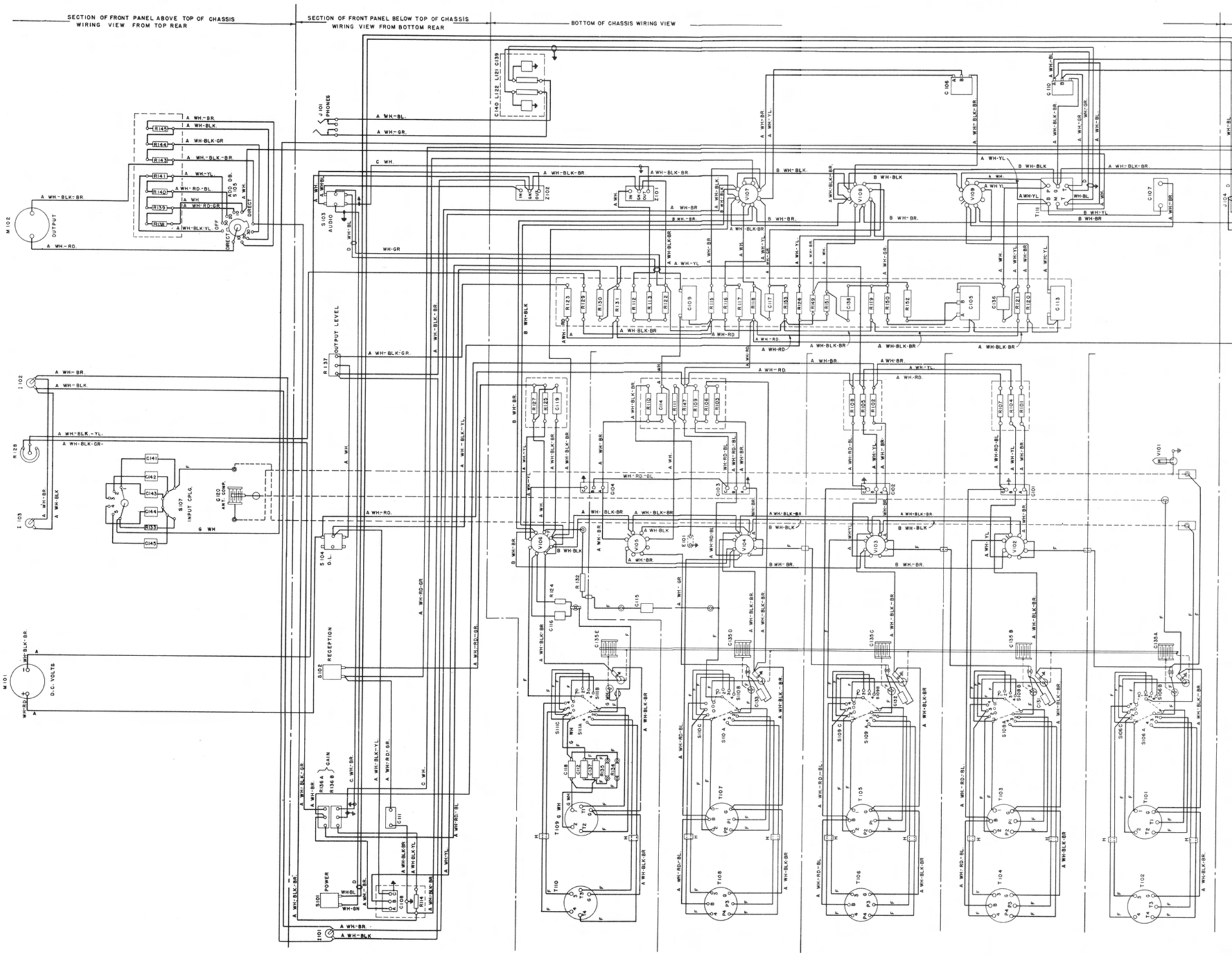


*Figure 7–17. Receiver Wiring Diagram*

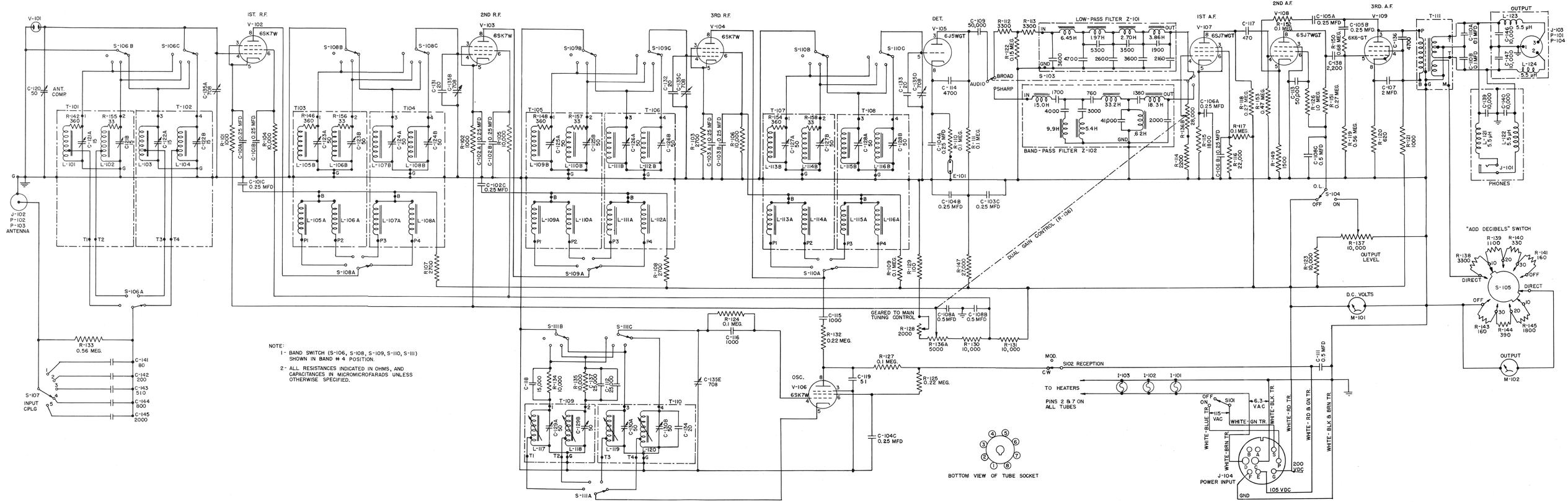


Figure 7–16. Receiver Schematic Diagram

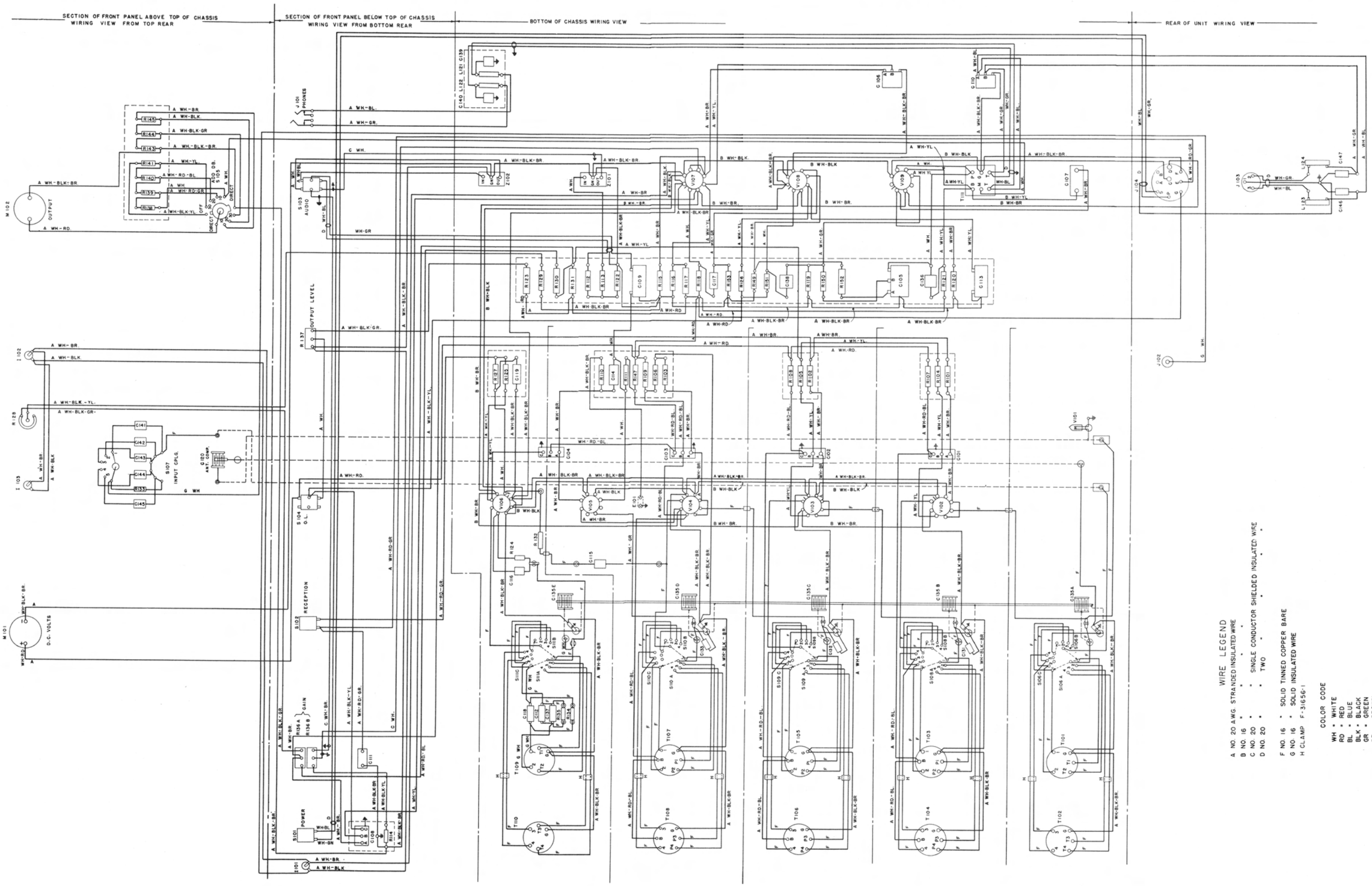


*Figure 7–17. Receiver Wiring Diagram*